# IASRI

# ANNUAL
# REPORT

## 2013-14

**INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE**
(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)
LIBRARY AVENUE, PUSA, NEW DELHI – 110 012
www.iasri.res.in

## 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 (A) | March 2013 onwards |

# Preface

It is a matter of great pleasure and satisfaction to present the Annual Report of Indian Agricultural Statistics Research Institute (IASRI) for the period 2013-14. The Institute was awarded an ISO certificate this year. The Institute has used the power of Statistics along with Informatics and has contributed significantly in improving the quality of Agricultural Research. During the year, the Institute has made some outstanding and useful research contributions 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 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.

The Institute has strengthened its research activities in Agricultural Statistics and Informatics through the in house and externally funded projects, network and inter-institutional collaborations and capacity building. The research was carried out under 77 research projects in the Institute (39 Institute funded, 24 funded by outside agencies, 13 in collaboration with other Institutes and 1 National Professor Scheme). This year 25 projects were completed and 20 new projects were initiated.

The institute feels proud to have established the first supercomputing hub for Indian Agriculture, ASHOKA (Advanced Super-computing Hub for OMICS Knowledge in Agriculture) which was dedicated to the nation by the Honourable Agriculture Minister Sh. Sharad Pawar. The Institute has also developed and implemented the ICAR-ERP solution for Financial, Project, Material, Human Resource Management and Payroll at ICAR. The Institute has made its presence felt in the National Agricultural Research System. 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 strengthened by adding new modules. Appropriate statistical techniques have been developed and recommended to researchers through advisory services.

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.

IASRI has contributed significantly by providing excellent human resource to National Agricultural Research and Education System in the country in the disciplines of Agricultural Statistics and Informatics for meeting the challenges of Agricultural Research in the newer emerging areas. Twenty-one training programmes were organised by the Institute during this period that includes training programmes conducted under Centre of Advanced Faculty Training, Summer/Winter Schools, Customized trainings, NAIP funded and training programmes for Technical Personnel of ICAR. In all, 374 participants have been trained in these training programmes. This year 16 students {2 Ph.D. (Agricultural Statistics), 8 M.Sc. (Agricultural Statistics), 5 M.Sc. (Computer Application) and 1 M.Sc. (Bioinformatics)} have completed their degrees. A Senior Certificate Course in Agricultural Statistics and Computing was also organized. The Institute had organized a National Conference of Agricultural Research Statisticians at NDRI Karnal with the theme of National Priorities in Agricultural Statistics and Informatics. The Institute has scored 100 percent in the Results Framework Document for the year 2013-14.

Scientists of the Institute have published 105 research papers in National and International refereed Journals along with 29 popular articles, 1 book, 20 book chapters and 55 project reports/ technical reports/reference manuals.

I am extremely happy to share that some of our colleagues received academic distinctions during the year. Dr. Hukum Chandra received Lal Bahadur Shastri Outstanding Young Scientist Award-2012 of ICAR for his outstanding contribution in the field of Social Sciences, Dr. Dinesh Kumar received Fellow Award 2012 by Society of Applied Biotechnology for outstanding contributions to the field of bioinformatics, Dr. Bishal Gurung received Dr. GR Seth Memorial Young Scientist Award (2013) from Indian Society of Agricultural Statistics (ISAS), Dr. Arpan Bhowmik received IARI Merit Medal for Ph.D. Research during the 52nd Convocation of PG School IARI, Dr. Anil Rai received Team Award from Indian Society of Agricultural Engineering for significant contribution in the work on Assessment of Harvest and Post-Harvest Losses of Major Crops and Livestock Produce in India and Dr. Rajender Parsad was awarded ISAS Fellow. The scientists of the Institute were deputed in various national/ international conferences. This year, ten scientists were deputed on different assignments to Bangladesh, Brazil, Bhutan, Thailand, Ethiopia, Oman, Kenya, USA and Spain.

I am deeply indebted to Hon'ble Dr. S Ayyappan, Secretary, DARE and Director General, ICAR, New Delhi for his encouragement, guidance and support. I am grateful to DDG (Engg.), ICAR, New Delhi for his constant direction, inspiration and backing. I express 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.

It is expected that the scientists in NARS will be immensely benefitted from the information contained in this publication. I look forward to any suggestions and comments for its improvement.

**(UC Sud)**
**Director (A)**

# Milestones

| Year | Milestone |
|---|---|
| 1930 | • Statistical Section created under ICAR |
| 1940 | • Activities of the Section increased with appointment of Dr. PV Sukhatme |
| 1945 | • Re-organisation of Statistical Section into Statistical Branch as a centre for research and training in the field of Agricultural Statistics |
| 1949 | • Re-named as Statistical Wing of ICAR |
| 1952 | • Activities of Statistical Wing further expanded and diversified with the recommendations of FAO experts, Dr. Frank Yates and Dr. DJ Finney |
| 1955 | • Statistical Wing moved to its present campus |
| 1956 | • Collaboration with AICRP initiated |
| 1959 | • Re-designated as Institute of Agricultural Research Statistics (IARS) |
| 1964 | • Installation of IBM 1620 Model-II Electronic Computer |
| | • Signing of MOU with IARI, New Delhi to start new courses for M.Sc. and Ph.D. degree in Agricultural Statistics |
| 1970 | • Status of a full fledged Institute in the ICAR system, headed by Director |
| 1977 | • Three storeyed Computer Centre Building inaugurated |
| | • Installation of third generation computer system, Burroughs B-4700 |
| 1978 | • Re-named as Indian Agricultural Statistics Research Institute (IASRI) |
| 1983 | • Identified as Centre of Advanced Studies in Agricultural Statistics and Computer Applications under the aegis of the United Nations Development Programme (UNDP) |
| 1985–86 | • New Course leading to M.Sc. degree in Computer Application in Agriculture initiated |
| 1989 | • Commercialization of SPAR 1.0 |
| 1991 | • Burroughs B-4700 system replaced by a Super Mini COSMOS LAN Server |
| 1992 | • Administration-cum-Training Block of the Institute inaugurated |
| 1993–94 | • M.Sc. degree in Computer Application in Agriculture changed to M.Sc. in Computer Application |
| 1995 | • Centre of Advanced Studies in Agricultural Statistics & Computer Application established by Education Division, ICAR |
| 1996 | • Establishment of Remote Sensing & GIS lab with latest software facilities |
| | • Outside funded projects initiated |
| 1997 | • Senior Certificate Course in 'Agricultural Statistics and Computing' revived |
| | • Establishment of modern computer laboratories |
| | • First software in India for generation of design along with its randomised layout SPBD release 1.0 |
| 1998 | • Four Divisions of the Institute re-named as Sample Survey, Design of Experiments, Biometrics and Computer Applications |
| | • Revolving Fund Scheme on Short Term Training Programme in Information Technology initiated |
| | • Training programmes in Statistics for non-statisticians in National Agricultural Research System initiated |
| 1999 | • Strengthening of LAN & Intranet with Fibre optics & UTP cabling |
| | • Substantial growth in outside funded projects and training programmes |
| 2000 | • Two Divisions re-named as Division of Forecasting Techniques and Division of Econometrics |

| 2001 | • | Data Warehousing activities (INARIS project under NATP) initiated |
|------|---|---|
| 2002 | • | Development of PIMSNET (Project Information Management System on Internet) for NATP |
| 2003 | • | Establishment of National Information System on Long-term Fertilizer Experiments funded by AP Cess Fund |
| | • | Development of PERMISnet (A software for Online Information on Personnel Management in ICAR System) |
| | • | First indigenously developed software on windows platform Statistical Package for Factorial Experiments (SPFE) 1.0 released |
| 2004 | • | National Information System on Agricultural Education (NISAGENET) Project launched |
| | • | Training Programme for private sector initiated and conducted training programme for E.I. DuPont India Private Limited |
| | • | E-Library Services initiated |
| 2005 | • | Statistical Package for Augmented Designs (SPAD) and Statistical Package for Agricultural Research (SPAR) 2.0 released |
| | • | Design Resources Server with an aim to provide E-advisory in NARS initiated |
| 2006 | • | Organisation of International Conference on Statistics and Informatics in Agricultural Research |
| 2007 | • | Establishment of Agricultural Bioinformatics Laboratory (ABL) |
| 2008 | • | Software for Survey Data Analysis (SSDA) 1.0 released |
| 2009 | • | Golden Jubilee Celebration Year of the Institute |
| | • | Strengthening Statistical Computing for NARS initiated |
| | • | Expert System on Wheat Crop Management launched |
| | • | International Training Hostel inaugurated |
| 2010 | • | Establishment of National Agricultural Bioinformatics Grid (NABG) in ICAR initiated |
| | • | Division of Biometrics re-named as Division of Biometrics and Statistical Modelling |
| | • | Division of Forecasting Techniques and Division of Econometrics merged to form Division of Forecasting and Econometrics Techniques |
| | • | A new centre namely Centre for Agricultural Bioinformatics [CABin] created |
| 2011 | • | Maize AgriDaksh and Expert System on Seed Spices launched |
| | • | Service Oriented Computing Services initiated |
| | • | Strengthening Statistical Computing for NARS Portal initiated |
| | • | M.Sc. degree in Bioinformatics initiated |
| 2012 | • | Software for Survey Data Analysis (SSDA) 2.0 released |
| | • | Division of Biometrics and Statistical Modelling re-named as Division of Statistical Genetics |
| | • | Division of Forecasting & Econometrics Techniques re-named as Division of Forecasting & Agricultural System Modeling |
| | • | Development of Management Information System (MIS) including Financial Management System (FMS) in ICAR initiated |
| | • | Half-Yearly Progress Monitoring (HYPM) System in ICAR implemented |
| | • | Sample Survey Resources Server initiated |
| 2013 | • | High Performance Computing (HPC) System for Biological Computing established |
| | • | Ph.D. degree in Computer Application initiated |
| | • | Certified as ISO 9001:2008 (Quality Management System) Institute |
| 2014 | • | Advanced Supercomputing Hub for OMICS Knowledge in Agriculture (ASHOKA) inaugurated |
| | • | ICAR-ERP system implemented |

## 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

Indian Agricultural Statistics Research Institute (IASRI) since its inception is mainly responsible for conducting research in Agricultural Statistics to bridge the gaps in the existing knowledge. 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. 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. The Institute feels proud to have established the first supercomputing hub for Indian Agriculture, ASHOKA (Advanced Super-computing Hub for OMICS Knowledge in Agriculture), which was dedicated to the nation by the Honourable Agriculture Minister on January 15, 2014. Further, an ICAR-ERP system consisting of a robust and flexible Management Information System (MIS) including Financial Management System (FMS) in ICAR has also been developed and implemented. A healthy statistical computing environment has been created in the NARS through the project Strengthening Statistical Computing for NARS. The Institute has been ISO-9001:2008 certified. The Institute's theme song has been prepared.

To achieve its goal and mandate, a number of research projects were undertaken in the Institute during the year. Research was carried out under 77 research projects (39 Institute funded, 24 externally funded by outside agencies, 13 in collaboration with other Institutes and 1 National Professor Scheme) in various thrust areas. This year 25 projects were completed and 20 new projects were initiated.

Some salient research achievements are as follows:

- To facilitate comparison among general combining ability (gca) effects free from specific combining ability (sca) effects under a two-way blocking set up for test vs. control comparisons, Mating-Environmental Row-Column (MERC) designs have been developed for comparing test lines with a control line suitable for breeding programmes. Methodology for orthogonal partition of the information matrix for estimating elementary contrasts pertaining to gca and sca effects for a diallel (or partial diallel) cross experiment laid out under a two-way blocking set up has also been developed. Macros in SAS software have been developed for the generation, randomization and analysis of MERC designs.

- In a row-column design set up, because of practical considerations it may not be possible to accommodate more than two experimental units in a column. A general method of constructing row-column design with two rows has been developed for orthogonal estimation of main effects and two factor interactions in minimum number of runs for orthogonal parameterization. In some experimental situations, like designs for 2-colour micro-array

experiments, where null state or baseline may exist, a general procedure of obtaining efficient w-optimal row-column designs in two rows for mixed level factorial experiments based on baseline parameterization has been developed.

- In several designed experiments, the experimental units exhibit a smooth trend over time or space. In case of factorial experiments, to estimate orthogonally all the main effects and lower order interaction effects, a general method of construction of multi-level factorial experiments that are linear trend-free for main effects and few lower order interaction effects has been developed.

- Block model with spatial indirect effects from neighbouring units at distance two incorporating trend component has been studied and conditions for the block design to be trend free have been derived. Series of trend free block designs balanced for spatial indirect effects from neighbouring units at distance two have been obtained.

- Information System for Designed Experiments conducted in India has been developed and is available on http://www.iasri.res.in. This on-line information system is a centralized storage of designed experiments mainly agricultural field experiments (excluding pure varietal trials) conducted in the country, on-farm and on-station experiments conducted under the Project Directorate of Farming System Research and Long Term Fertilizer Experiments conducted under the All India Coordinated Research Project on Long Term Fertilizer Experiments.

- Indian NARS Statistical Computing Portal (http://stat.iasri.res.in/sscnarsportal) has been strengthened by adding the modules of Cross over designs and Estimation of genetic variance-covariance from block designs. The 24 analysis modules available on this portal have been classified into four broad categories as Basic Statistics, Design of Experiments, Multivariate Analysis and Statistical Genetics.

- For creation of research data repository and standardization of analysis of data of All-India Coordinated Sorghum Crop Improvement Project, a prototype has been developed by NAARM, Hyderabad and IASRI, New Delhi in collaboration with Directorate of Sorghum Research Hyderabad.

This system was made operational and made available at www.aicsip.naarm.org.in.

- There are situations where the relationship between variable of interest and covariates (e.g., relationship between yield and fertilizer) is not constant over the study space, referred to as spatial nonstationarity. A suitable Small Area Estimation (SAE) methodology has been developed which accounts for presence of spatial nonstationarity in the data. In particular, a geographically weighted pseudo empirical best linear unbiased predictor under area level model was developed with geographical weighted regression approach to model spatial nonstationarity. In addition, MSE estimation method has been developed. The developed SAE method was applied to produce district level estimates of crop yield for paddy in the State of Uttar Pradesh. The developed SAE method has shown very encouraging results in producing reliable micro level statistics.

- A SAE technique for skewed data was developed that can be modelled linearly following a non-linear transformation, in particular a logarithmic transformation. An efficient estimator (referred to as empirical best predictor (EBP)) of small area means for skewed data has been developed.

- The crop cutting experiment approach is used in our country to develop yield rate estimates of different crops. Cotton is a multiple picking crop. It was required that simpler methodology may be developed for its production estimation on the basis of limited number of pickings. Secondary data analysis of crop cutting experiments of cotton revealed that second/third picking yield is highly correlated with the yield based on total number of pickings. Using the second/third picking data as auxiliary variable and the total picking data as study variable a simplified methodology has been developed through the use of double sampling regression estimator.

- Auxiliary information plays a very significant role in sample survey related problems. The available auxiliary information can be used to properly design surveys, in sample selection and in developing precise estimators. Calibration approach provides a systematic approach for incorporating auxiliary information at the estimation stage. Using

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calibration approach, precise estimators of finite population mean/total are developed for two-stage sampling design. Improved variance estimators are also developed. The gains in precision are demonstrated with the help of simulation studies.

- The impact of introduction of poplar tree based agroforestry in Vaishali district of Bihar state has been assessed. It was concluded that agroforestry had a great impact on the socio-economic condition of the farmers of Vaishali district and it is recommended that the poplar based agroforestry model may be implemented in all the districts of Bihar in particular and all the states of the country in general for overall socio-economic development of farmers of the country.

- The quality aspects of crop estimation surveys has been a cause of concern in the Directorate of Economics and Statistics (DES), Ministry of Agriculture. Prof. Vaidyanathan committee, constituted for improvement of agricultural statistics, recommended sample sizes for reliable crop area and crop yield estimation. A study was taken up to examine the feasibility of sample sizes recommended by the committee. The study, using the ICS (Improvement of Crop Statistics) scheme data, revealed that the recommended sample sizes were adequate to estimate average yields of paddy and wheat crops. For other crops, the recommended sample sizes were not adequate for estimating the average yield. Also, ICS based sample sizes were not adequate for crop area estimation.

- Non-response is a common problem in sample surveys that results in estimates that are biased. Hansen and Hurwitz (1946) proposed a technique essentially to adjust for non-response. Using the calibration approach, the Hansen and Hurwitz (1946) technique based estimator was developed for the situation where the information on auxiliary variable is assumed to be known for the entire population units. The expression for variance and variance estimators were developed. The empirical results demonstrated that the proposed calibration approach based estimators outperformed the Hansen and Hurwitz (1946) estimator.

- Agricultural Research Data Book (ARDB) 2013 was prepared which is the sixteenth in the series.

Information pertaining to main components/indicators pertaining to agricultural research, education and related aspects available from different sources in the country till the end of June, 2013 is put together in this document. For depicting state-wise data, thematic maps have been prepared using Geographical Information System (GIS).

- Agricultural production is characterized by risks and uncertainties largely due to uncertain yields and relatively low price elasticity of demand of most commodities. Commodity price movements have a major impact on overall macroeconomic performance and hence commodity-price forecasts are a key input to macroeconomic policy planning and formulation. To forecast onion prices before the crop arrival and particularly in the lean periods which witnesses high rise in onion price, a study on forecasting agricultural commodity prices using time series data was undertaken and it has been shown that Generalized Autoregressive Conditional Heteroscedastic (GARCH) is a better model than Autoregressive Integrated Moving Average (ARIMA) for estimating daily prices.

- The ARIMA methodology may not be able to properly model many nonlinear time-series data such as oil sardine, Mackerel and Bombay duck landings data. In such situation, Exponential Smooth Transition Autoregressive (ESTAR) model can be applied. The procedure for estimation of parameters of ESTAR using Particle Swarm Optimization (PSO) technique was developed. The performance of fitted model was compared and it was concluded that ESTAR models perform better than ARIMA for the datasets under consideration.

- A user friendly software has been developed for estimating the compound growth rate (WebECGR) and the same is available at http://iasri.res.in/cgr.

- Presence of long memory has been tested in the wholesale price of pigeonpea in Amritsar and Bhatinda market as well as in Maximum, Minimum and Modal price of pigeonpea at All India level. All the five series showed the presence of long memory. Accordingly, Autoregressive Fractionally Integrated Moving Average (ARFIMA) model has been fitted for modelling and forecasting of wholesale price of above series. The long memory parameter has

been estimated by GPH estimator (Geweke and Porter-Hudak, 1983), Gaussian Semi parametric estimator (Robinson, 1995) as well as by wavelet methodology (Jensen, 1999). Simulation study revealed that wavelet method is better than other in terms of minimum mean squared errors.

- Crop yield prediction model was developed using Nonlinear Support Vector Regression (NLSVR) technique and illustrated for predicting maize crop yield. As an illustration, maize crop yield data as response variable and total human labour, farm power, fertilizer consumption and pesticide consumption as predictor variables were considered. Performance of a fitted model was assessed in terms of Root mean square error (RMSE), Mean absolute error (MAE) and Mean absolute prediction error (MAPE). Superiority of NLSVR technique over artificial neural network technique was demonstrated for the data under consideration. It was concluded that NLSVR methodology was quite successful for modelling as well as prediction purposes.

- National Agricultural Bioinformatics Grid (NABG) has been established in ICAR. A number of databases and tools have been developed under NABG 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.

- Tomato MicroSatellite Database (TomSatDb), the first whole genome based microsatellite DNA marker database of tomato has been developed that houses a total of 146602 STR markers, mined in-silico, using MIcroSAtellite (MISA) tool. To cater to the customized needs of wet lab, automated primer designing tool is added. It is available at http://webapp.cabgrid.res.in/tomsatdb.

- A web based relational database has been developed consisting of 865210 microsatellite markers present in the whole genome sequence of goat. GoSatdb allows microsatellite search using multiple parameters. It is available at http://webapp.cabgrid.res.in/goat/.

- The first goat breed identification server using microsatellite DNA markers has been developed

and made available at http://cabin.iasri.res.in/gomi/.

- A web based cattle breed identification server has been developed for maintaining reference data and breed identification. The reference data used for developing prediction model were obtained from 8 cattle breeds and 18 microsatellite DNA markers yielding 18000 allele data. This server is available at http://cabin.iasri.res.in/biscattle/.

- National Agricultural Biocomputing portal has been developed that provides a single point of access to High Performance Computing (HPC) resources. The portal provides an environment to carry out the bioinformatics tasks. The portal facilitates the user in submitting and managing application specific jobs. The jobs submitted through the portal are scheduled and resources are allocated through the Resource Manager. The portal supports computational requirements of the biotechnological research in the country. This will bridge the gap between genomic information and knowledge, utilizing statistical and computational sciences and in establishing the large genomic databases, data warehouse, software tools, algorithms, genomic browsers with high end computational power to extract information and knowledge from cross-species genomic resources.

- A secured genome submission portal has been developed with a backend database following standard database management concepts (http://nabg.iasri.res.in). This initiative has been taken to build indigenous genome database and analysis platform in the country. Advanced hardware resources and parallel computing facilities have been installed for high speed information processing and knowledge extraction from this database.

- Transcription factors (TFs) and microRNAs (miRNAs) are primary gene regulators within the cell. Regulatory mechanisms of these two main regulators provide insights into the abiotic and biotic stress. Not much is known about the mechanism that how miRNA regulated TF's target genes employ to effect co-ordinated regulation within the stress effected cell. An in-silico analysis pipeline is proposed to find transcriptional modules

for regulatory gene expression signatures like miRNA and TFs.

- Protein-protein interactions are interactions between proteins that take place due to certain chemical reactions and electrostatic forces. The prediction of protein-protein interactions is done using the structural information along with physio-chemical features like hydrophobicity, x-coordinates, y-coordinates, z-coordinates, surface tension, charge, alpha helix, β helix, turn, van der waals, molecular weight, solubility etc. An algorithm for prediction of protein-protein interaction using Support Vector Machine (SVM) has been developed.

- A web interface has been developed to fetch orthologous annotated data of buffalo genes on cattle genome. A browser using light weight genome viewer tool has been developed for mapping buffalo genes on to cattle genome.

- Antimicrobial peptide prediction models have been developed using SVM for classification of antimicrobial peptides and the same have been evaluated and compared for performance. Since SVM models performed better than ANN, these were implemented in the web server for N-terminal, C-terminal and Full sequence using CGI-PERL, HTML, PHP and available at http://cabin.iasri.res.in/amp.

- Problem of prediction of trait associated genes can be framed as a feature selection problem where genes of microarray data may be considered as features and the selected key genes are indicative of a trait. Non-linear Penalized Support Vector Machine (SVM) is used to predict the key genes belonging to a particular trait and it also provides a measure of prediction accuracy based on cross validation technique.

- A bioinformatics workflow system is a specialized form of workflow designed specifically to compose and execute a series of computational or data manipulation steps, or a workflow, in a specific domain. Developed and build a local genome database required for workflows, a parallelized pipeline for identification of gene from Expressed Sequence Tags (ESTs), a workflow system for phylogenetic analysis on parallel architecture and

a pipeline for identification of SSR Markers and primer designing using parallel computing tools and libraries. *The software for online phylogenetic analysis has also been developed.*

- A robust and flexible Management Information System (MIS) including Financial Management System (FMS) in ICAR has been developed which includes solution for Financial Management, Project Management, Material Management, Human Resource Management and Payroll at ICAR. For this, an ICAR-ERP solution has been developed. A number of training programs were organized at IASRI and partner organizations for imparting training to institute personnel on different modules of ICAR-ERP solution. User Acceptance Testing (UAT) workshops were organized in IASRI.

- IASRI Agropedia, an online knowledge repository and knowledge management platform for information related to agriculture has been developed. It hosts wide range of agricultural information on a variety of crops in a variety of ways. The Agropedia portal is currently available at http://www.agropedia.in. A knowledge model has been prepared for forecasting techniques. It gives general information related to forecasting methods, applications, stages and some models.

The institute organized XVII National Conference of Agricultural Research Statisticians jointly with National Dairy Research Institute (NDRI) at NDRI, Karnal during November 27-28, 2013 wherein five technical sessions on Agricultural Statistics and Informatics were organized. 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 while for the year 2013-14, the Institute got a score of 100.

Scientists of the Institute have published 105 research papers in National and International refereed Journals along with 29 popular articles, 1 book, 20 book chapters, 9 papers in conference proceedings and 55 project reports/technical bulletins/reference manuals/brochures. Besides,  23 e-resources/macros available at Institute's website were also developed.

This year, 21 training programmes were organized in which 374 participants were imparted training.

- Five 21 days training programme under Centre of Advanced Faculty Training on Recent Advances in Statistical Modelling Techniques, Advances in Statistical Genetics, Advances in Statistical Methods for Animal Experiments, Advances in Experimental Designs for Development of Technologies in Agriculture and Computational and Statistical Advances in Bioinformatics for 'Omics' Data were organised.

- Two Summer/Winter Schools on Forecast Modelling in Crops and Development of Web Application for Agricultural Management were organized.

- Six training programmes were conducted under National Agricultural Innovation Projects: Data Analysis using SAS, Advanced User Training of CLC Bio Software, Computational Aspect for NSG data Analysis: A Sojonum from Lab to Field at Ome research facility under NABG and Advanced Analytical Techniques in Bioinformatics under Bioprospecting of genes and allele mining for abiotic stress tolerance.

- Three Resource Generation training programmes were conducted on Data Analysis and Interpretation for ISS probationers sponsored by CSO, Ministry of Statistics & Programme Implementation and other two on Integrated Sample Survey Methodology (refresher course) sponsored by Department of Animal Husbandry, Dairying & Fisheries, Government of India.

- Five other training programmes on Data Base Management System for Technical Personnel of ICAR, Functions and Activities of IASRI for NASA, Statistics Module of the Subject Matter Training for Scientists from Islamic Republic of Afghanistan, Modular Course on Statistical Methods for Agricultural Research for the participants of an International M.Sc. Programme for Afghan Nationals on Teaching of Post-Graduate courses in Agronomy were organized. A training workshop on Computer Assisted Text Analysis under 'Mapping the Cultural Authority of Science across Europe and India (MACAS-EU & INDIA) sponsored by Indian Council of Social Science Research was also organized.

Scientists of the institute have brought laurels to the Institute by receiving awards from different agencies.

Dr. Hukum Chandra received Lal Bahadur Shastri Outstanding Young Scientist Award-2012 of ICAR on 16 July 2013 for his outstanding contribution in the field of Social Sciences, Dr. Dinesh Kumar received Fellow Award 2012 by Society of Applied Biotechnology in recognition of outstanding achievements and contributions to the field of bioinformatics, Dr. Bishal Gurung received Dr. GR Seth Memorial Young Scientist Award 2013 from Indian Society of Agricultural Statistics (ISAS), Dr. Arpan Bhowmik received IARI Merit Medal for Ph.D. Research during the 52nd Convocation of PG School IARI, Dr. Anil Rai 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" and Dr. Rajender Parsad was awarded ISAS Fellow.

Dr. UC Sud visited Bangladesh in connection with the third mission on Dissemination Workshop related to the project "Harmonization and dissemination of unified agricultural production statistics in Bangladesh, Rio-de-Janeiro, Brazil to present a Paper entitled "District level crop yield estimation under spatial small area model" in the Sixth International Conference on Agricultural Statistics (ICAS-VI) and Bhutan for providing Consultancy on Sampling and Research Methodologies.

Dr. Hukum Chandra was deputed as Member, Scientific Committee, for attending the First Asian International Statistical Institute Satellite Conference on Small Area Estimation at Bangkok, Thailand. He also visited Ethiopia as a FAO Consultant.

Dr. Prachi Misra Sahoo visited Oman to provide Consultancy to Ministry of Agriculture and Fisheries, Sultanate of Oman. Dr. Sanjeev Panwar visited Nairobi, Kenya as a resource person for taking sessions on Genotype x Environment Analysis in the training on "Application of Biometrics and Bioinformatics Tools in Crop Improvement Research".

Dr. MA Iquebal and Dr. Sarika were deputed to attend NAIP funded International training in "Bioinformatics" for three months at Iowa State University, Ames, Iowa, USA. Md. Samir Farooqi was deputed to attend international training in the area of Bioinformatics and Comparative Genomics at Department of Agronomy, Iowa State University, Ames, Iowa, USA. Sh. KK Chaturvedi was deputed at Cornell University, Ithaca,
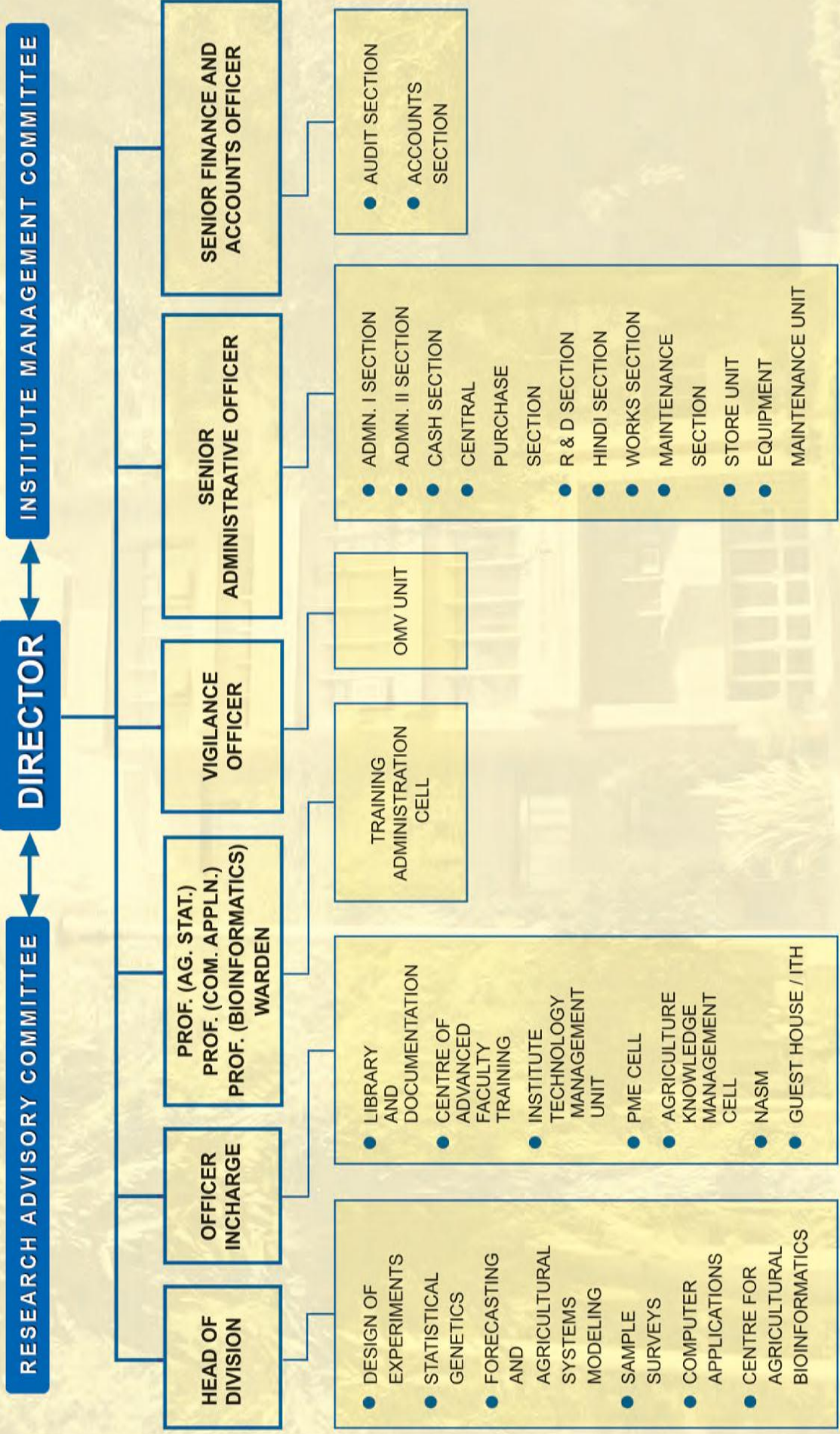
USA for receiving training on "Bioinformatics" under NAIP. Dr. DC Mishra was deputed to attend training in the area of computational biology for three months at Department of Bioinformatics and Biostatistics, University of Louisville, Kentucky, USA. Dr. Susheel Kumar Sarkar was deputed to attend training on Integrated Breeding Multi-Year Course (IB-MYC) Year 2 under Generation Challenge Programme-Integrated Breeding Platform (GCP-IBP) at Mediterranean Agronomic Institute of Zaragoza (IAMZ) in Zaragoza, Spain.

The activities relating to education and training which included planning, organization and coordination of the entire Post-graduate teaching programmes of the Institute were undertaken in collaboration with PG School, IARI. During the year, a total of 16 students {02 Ph.D. (Agricultural Statistics), 08 M.Sc. (Agricultural Statistics), 05 M.Sc. (Computer Application) and 01 M.Sc. (Bioinformatics)} completed their degrees. 23 new students {05 Ph.D. (Agricultural Statistics), 08 M.Sc. (Agricultural Statistics), 02 Ph.D. (Computer Application), 04 M.Sc. (Computer Application) and 04 M.Sc. (Bioinformatics)} were admitted.

A Senior Certificate Course in Agricultural Statistics and Computing was organised and 02 officials participated in this Certificate Course.

# ORGANOGRAM

## INSTITUTE MANAGEMENT COMMITTEE

## RESEARCH ADVISORY COMMITTEE

### DIRECTOR

- **SENIOR FINANCE AND ACCOUNTS OFFICER**
  - AUDIT SECTION
  - ACCOUNTS SECTION

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

- **VIGILANCE OFFICER**
  - OMV UNIT

- **PROF. (AG. STAT.) PROF. (COM. APPLN.) PROF. (BIOINFORMATICS) WARDEN**
  - TRAINING ADMINISTRATION CELL

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

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

# Introduction

Indian Agricultural Statistics Research Institute (IASRI) is an ISO 9001:2008 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. ISO 9001: 2008 is an international standard related to quality management system, applicable to any organization from all types of business sectors and activities. The certificate of ISO 9001: 2008 was issued by Equalitas Certifications Limited on 18 November 2013 and is valid till 17 November 2016. The Institute has prepared a theme song highlighting its functions and activities and is played before the start of every important meetings. 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 functions and activities of the Institute have been re-defined from time to time in the past. The present main thrust of the Institute is to undertake research, education and training in the discipline of Agricultural Statistics, Computer Applications and Bioinformatics and to develop trained manpower to address emerging challenges in agricultural research.

The contributions towards research, teaching and training have been monumental. Since scenario of agriculture research is changing at a very fast rate, the Institute has set its future agenda to meet the statistical and informatics needs. The efforts are to become a lead organization in the world in the field of agricultural statistics, statistical computing, informatics including bioinformatics, and be responsive, vibrant and sensitive to the needs of researchers, research managers and planners.

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 System (NARS). The Institute is

also becoming progressively a repository of information on agricultural research data and has taken a lead in the country in developing a data warehouse on agricultural research data. IASRI is implementing the robust and flexible MIS & FMS System which includes solution for Financial Management, Project Management, Material Management, Human Resource Management and Payroll at ICAR. The Institute has established linkages with all NARS organizations for strengthening statistical computing. A National Agricultural Bioinformatics Grid has been developed with high performance computing facilities. 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. Some of the research activities and their impact are given in the sequel:

**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; designs for agroforestry experiments;

- Diagnostics in designed field experiments;

- Computer aided construction of efficient designs for various experimental settings; etc.

- The creation of Design Resources Server, an e-learning and e-advisory resource for the experimenters, has been another revolution in the growth of the Institute. The server provides a platform to popularize and disseminate research and also to further strengthen research in newer emerging areas in design of experiments among peers over the globe in general and among the agricultural scientists in particular so as to meet the emerging challenges of agricultural research. This server is hosted at www.iasri.res.in/design.

- 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 NARS 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, $\alpha$-designs, reinforced $\alpha$-designs, square and rectangular designs, nested designs, augmented designs, extended group divisible designs, response surface designs, experiments with mixtures etc. have been adopted widely by the experimenters in NARS.

- 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 NARS.

- The status of experimentation is changing and with the support provided in terms of suggesting efficient designs and analyzing the data using modern complicated statistical tools, the research publications of the agricultural scientists are finding a place in high impact factor international journals.

## 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 and allied fields.

- Significant contributions have been made in theoretical aspects of sample surveys like successive sampling, systematic sampling, cluster sampling, sampling with varying probabilities, controlled selection, nonsampling errors, analysis of complex surveys, various methods of estimation such as ratio and regression methods of estimation, calibration approach based estimators, small area estimation, use of combinatorics in sample surveys.

- 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.

- Methodology based on small area estimation technique for National Agricultural Insurance Scheme, also called Rashtriya Krishi Bima Yojana, suggested by IASRI has been pilot tested in the country.

- Sample survey methodologies 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. have 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 Assessment of Integrated Area Development programmes, High Yielding Varieties programmes, Dairy Improvement programmes, Evaluation of cotton production estimation methodology, Evaluation of agricultural census scheme, Evaluation of rationalization of minor irrigation statistics scheme etc. have been undertaken. Most of the methodologies developed are being adopted for estimation of respective commodities by the concerned state Departments.

- Sample Survey Resources Server has also been created with a goal to disseminate research in theory, application and computational aspects of sample survey among the statisticians in academia, practicing statisticians involved in advisory and consultancy services, scientists in the National Agricultural Research System, and the statisticians involved in conducting large scale sample surveys, particularly in the National Statistical System with focus on agricultural statistical system.

- 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.

## Statistical Genetics and Genomics

The Institute has made very significant contributions in statistical genetics for improved and precise estimation of genetic parameters, classificatory analysis and genetic divergence, etc.

- 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 environment interactions have been

developed and used for the analysis of data generated from crop improvement programmes.

- 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.

## Statistical Modelling

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.

## Econometrics

The Institute has made significant contributions in understanding the complex economic relationship of the factors like transportation, marketing, storage, processing facilities; constraint 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 Technology

IASRI is pioneer in introducing computer culture in agricultural research and human resource development in information technology in the ICAR. The Institute has

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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 systems for agricultural field experiments, animal experiments and long term fertilizer experiments conducted in NARS 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.

- 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).

- An online system for Half Yearly Progress Monitoring (HYPM) of the scientists in ICAR has also been developed.

- A Website (Vortal) has been developed to facilitate the online management of all training programs under Centre for Advanced Faculty Training (CAFT).

- A milestone in the research programmes of the Institute was created when it started developing indigenous statistical software packages mainly for analysis of agricultural research. A number of software and web solutions have been developed for the agricultural research workers.

- For providing service oriented computing, the Institute has developed Indian NARS Statistical Computing Portal which is available to NARS users through IP authentication and is being widely used by the researchers.

- 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 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 87 participants have completed both the modules, 38 have completed module-I and 21 have completed module-II since 1997.

- The Institute also conducts degree courses leading to M.Sc. and Ph.D. in Agricultural Statistics and M.Sc. in Computer Application in collaboration with Indian Agricultural Research Institute (IARI), New Delhi. Ph.D. degree in Computer Application has also been initiated from academic session 2013-14. The Institute has so far produced 184 Ph.D. and 322 M.Sc. students in Agricultural Statistics and 110 M.Sc. students in Computer Application. A new degree course M.Sc. in Bioinformatics has started from academic year 2011-12 in collaboration with IARI, New Delhi; NRCPB, New Delhi and NBPGR, New Delhi. The Institute has produced first batch of 01 student during 2013-14.

- The Institute is functioning as a Centre of Advanced Studies in Agricultural Statistics and Computer Application. Under this programme, the Institute organizes training programmes on various topics of interest for the benefit of scientists of NARS. These training programmes cover specialized topics of agricultural sciences. The Centre of Advanced Studies (CAS) is now re-named as Centre of Advanced Faculty Training (CAFT). So far, 56 training programmes have been organised under the aegis of CAS/CAFT and in all a total of 1054 participants have been benefited.

- 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 Organization 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 started expanding in all directions, the infrastructure facilities also started expanding. Two more buildings 'Computer Centre' and 'Training-cum-Administrative Block' were constructed in the campus of the Institute in the years 1976 and 1991, respectively. There are three well furnished hostels, viz. Panse Hostel-cum-Guest House, Sukhatme Hostel and International Training Hostel to cater to the residential requirements of the trainees and students. 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.

For undertaking research in the newer emerging areas, a laboratory on Remote Sensing (RS) and Geographic Information System (GIS) was created in the Institute. The laboratory was 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 under NATP programme.

An Agricultural Bioinformatics Lab (ABL) fully equipped with software and hardware has been created to study crop and animal biology with the latest statistical and computational tools. Business Intelligence Server has also been installed for statistical computing for NARS.

The networking services at IASRI have steadily been strengthened. Currently the internet services are being provided to the scientists, technical & administrative staff and students through Firewall, Content filtering, E-mail filtering, Antivirus, Application control and Data Leak Prevention (DPL). 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.

There are various labs at the Institute for dedicated services like ARIS lab for training, Statistical computing lab, Student lab and Centre of Advanced Study lab. Some of the important available software are SAS 9.2, SAS 9.3, JMP 8.0, JMP 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, MS Visual Studio.net, MS-SQL Server, Oracle, Macro-Media, E-views, STATISTICA, Neural Networks, Gauss Software, Minitab 14, Maple 9.5, Matlab, Web Statistica, Lingo Super, ArcGIS among others.

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.

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, agricultural economics, bioinformatics and allied sciences. It is recognized as one of the regional libraries under NARS with best IT agricultural library under ICAR system.

During the XI Plan period, the library has undergone ocean of 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.

**Organisational 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]

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**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:

**Details of Institute Non-Plan and Plan Expenditure for the year 2013-14**

| S. No. | Head | (Amount in Rupees) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | NON-PLAN | | | | | | PLAN | |
| | | Allocation Govt. Grant | Allocation Internal Resource + Additional amount provided by HQ out of Council's share | Total Allocation | Expenditure (Govt. Grant) | Expenditure (Revenue Generation) | Total Expenditure | RE Allocation | Expen-diture |
| 1. | 2 | 3 | 4 | 5 (3 + 4) | 6 | 7 | 8 (6 + 7) | 9 | 10 |
| 1. | Works | | | | | | | | |
| | A. Land | | | | | | | | |
| | B. Building | | | | | | | | |
| |   i. Office building | | | | | | | | |
| |   ii. Residential building | | | | | | | | |
| |   iii. Minor Works | | | | | | | | |
| | Equipments | 900000 | 0 | 900000 | 880844 | 0 | 880844 | 6300000 | 6262874 |
| 3 | Information Technology | | | | | | | 895000 | 894625 |
| 4 | Library Books and Journals | | | | | | | 3965000 | 3964128 |
| 5 | Vehicles & Vessels | | | | | | | | |
| 6 | Livestock | | | | | | | | |
| 7 | Furniture & fixtures | | | | | | | | |
| 8 | Others | | | | | | | | |
| | Total – CAPITAL (Grants for creation of Capital Assets) | 900000 | 0 | 900000 | 880844 | 0 | 880844 | 11160000 | 11121627 |
| 1 | Establishment Expenses (Salaries) | 215360000 | 20000000 | 235360000 | 212936247 | | 212936247 | | |
| |   i. Establishment Charges | | | | | | | | |
| |   ii. Wages | | | | | | | | |
| |   iii. Overtime Allowance | 40000 | | 40000 | 18445 | | 18445 | | |
| | Total – Establishment Expenses (Grant in Aid - Salaries) | 215400000 | 20000000 | 235400000 | 212954692 | 0 | 212954692 | | |

| # | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Pension & Other Retirement Benefits | 43300000 | 10000000 | 53300000 | 43300000 | 4767663 | 48067663 | | |
| 2 | TA | | | | | | | | |
| | A. Domestic TA / Transfer TA | 350000 | | 350000 | 340307 | | 340307 | 764000 | 762819 |
| | B. Foreign TA | | | | | | | | |
| | Total – Travelling Allowance | 350000 | | 350000 | 340307 | | 340307 | 764000 | 762819 |
| 3 | Research & Operational Expenses | | | | | | | | |
| | A. Research Expenses | 100000 | | 100000 | 10969 | | 10969 | 959000 | 958191 |
| | B. Operational Expenses | 100000 | | 100000 | 30596 | | 30596 | 95000 | 95000 |
| | Total - Research & Operational Expenses | 200000 | | 200000 | 41565 | | 41565 | 1054000 | 1053191 |
| 4 | Administrative Expenses | | | | | | | | |
| | A. Infrastructure | 12000000 | 6000000 | 18000000 | 12000000 | 5999340 | 17999340 | 8499000 | 8498211 |
| | B. Communication | 300000 | | 300000 | 307084 | | 307084 | 191000 | 190623 |
| | C. Repair & Maintenance | | | | | | | | |
| | i. Equipments, Vehicles & Others | 2400000 | | 2400000 | 1693628 | | 1693628 | 190000 | 189260 |
| | ii. Office building | 1500000 | | 1500000 | 1438202 | | 1438202 | 333000 | 295536 |
| | iii. Residential building | 2250000 | 550000 | 2800000 | 2250000 | 552269 | 2802269 | 926000 | 846654 |
| | iv. Minor Works | 500000 | | 500000 | 0 | | 0 | 0 | |
| | D. Others (excluding TA) | 12000000 | | 12000000 | 10638080 | | 10638080 | 946000 | 939976 |
| | Total - Administrative Expenses | 30950000 | 6550000 | 37500000 | 28326994 | 6551609 | 34878603 | 11085000 | 10960260 |
| 5 | Miscellaneous Expenses | | | | | | | | |
| | A. HRD | 500000 | | 500000 | 421649 | | 421649 | 499000 | 497821 |
| | B. Other Items (Fellowships, Scholarships etc.) | 5100000 | | 5100000 | 4185824 | | 4185824 | | |
| | C. Publicity & Exhibitions | | | | | | | | |
| | D. Guest House – Maintenance | 100000 | | 100000 | 66200 | | 66200 | 207000 | 206600 |
| | E. Other Miscellaneous | | | 0 | | | | 231000 | 214493 |
| | Total - Miscellaneous Expenses | 5700000 | 0 | 5700000 | 4673673 | | 4673673 | 937000 | 918914 |
| | Total --Grants in Aid - General | 80500000 | 16550000 | 97050000 | 76682539 | 11319272 | 88001811 | 13840000 | 13695184 |
| | Grand Total (Capital + Establishment + General) | 296800000 | 36550000 | 333350000 | 290518075 | 11319272 | 301837347 | 25000000 | 24816811 |
| 6 | Loans and Advances | | 600000 | | | 315920 | | | |

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**Staff Position (as on 31 March 2014)**

| Manpower | No. of posts sanctioned | No. of posts filled |
|---|---|---|
| Director | 1 | - |
| Scientific | 130 | 66 |
| Technical | 215 | 80 |
| Administrative | 84 | 75 |
| Canteen | 14 | 8 |
| Skilled Supporting Staff | 78 | 50 |
| **Total** | **522** | **279** |

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.

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# Research Achievements

The set research targets are being implemented by six Divisions of the Institute, 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 six broad programmes that cut across the boundaries of the Divisions and encourage interdisciplinary research. The six programmes are as under:

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**

**Row-column designs for factorial experiments in two rows**

In a row-column design set up, because of practical considerations it may not be possible to accommodate more than two experimental units in a column. One application of row-column designs with two rows is in experiments where the treatment structure is factorial in nature. Due to cost and time considerations, it may not be possible to run a design for estimation of all the factorial effects. The experimenter may, however, be interested in orthogonal estimation of all the main effects and two factor interactions. Thus, it is required to obtain a general method of construction of row-column designs with two rows, which permit orthogonal estimation of all main effects and two factor interactions and at the same time minimize the number of runs (or design points). To deal with such situations, a general method of construction of row-column designs with two rows for orthogonal estimation of main effects and two factor interactions in minimum number of runs has been given for orthogonal parameterization. A catalogue of efficient row-column designs for $2^n$ ($2 \leq n \leq 9$) factorial in minimum number of replications has been prepared. Here in, all the designs, main effects and two factor interactions are estimated orthogonally. A SAS program for checking the orthogonal estimation of main effects and two factor interactions has been developed and is available with the authors.

The above discussion relates to the factorial experiments run in row-column design, where the interest of the experimenter is in orthogonal parameterization of the factorial effects. However, in some experimental situations, like designs for 2-colour micro-array experiments, where null state or baseline

may exist, the experimenter would be interested in baseline parameterization rather than orthogonal parameterization. Since the designs obtained are in incomplete columns, it is important to study the optimality aspects of designs obtained. In other words, there is a need to obtain a general procedure of generating efficient w-optimal row-column designs in two rows for n-factors mixed level factorial experiment based on baseline parameterization. To deal with such situations, a general procedure of obtaining efficient w-optimal row-column designs in two rows for n-factors mixed level factorial experiments based on baseline parameterization has also been developed. An equation has been obtained to calculate the number of columns required to make a row-column design w-optimal. A catalogue of w-optimal row-column designs in two rows for n-factors mixed level factorial experiment based on baseline parameterization has been prepared.

**Trend free multi-level factorial experiments**

In several designed experiments, the experimental units exhibit a smooth trend over time or space. The trend may occur in greenhouse experiments where the source of heat is located on sides of the house and the experimental units (pots) are kept in lines; in poultry experiments where the source of heat is at the centre of the shed and chicks of early age are in the cages; in orchard and vineyard experiments on undulating topography, where response variable is affected by slowly migrating insects entering the area from one side; in laboratory experiments where the responses to the experimental units may be affected over time by instrument drift or analyst fatigue, etc. The presence of trend among the experimental units affects the analysis of data. One approach of analysis of data is to use the trend variable as a covariate and perform the analysis of covariance. It is, however, desirable to have trend free designs as in these designs the trend effects are orthogonal to the treatment effects. In other words, the treatment sum of squares adjusted for all other effects in the presence of trend is the same as the treatment sum of squares adjusted for all other effects in the absence of trend variable.

Designs for factorial experiments are very popular in agricultural sciences because of the fact that agriculture being complex phenomena, a very large number of factors influences the system. Generally the interest of the experimenter is to estimate orthogonally all the main effects and lower order interaction effects. In the presence of trend, it may, however, become difficult to estimate orthogonally all the main effects and preferably few lower order interactions. A general method of construction of multi-level factorial experiments that are linear trend-free for main effects and few lower order interaction effects has been developed. Using this method, a series of $3^n$ and $5^n$ designs for complete factorial experiments that are linear trend-free for all the main effects have been developed. Further, a series of multi-level fractional factorial plans for $3^{5-2}$, $3^{6-3}$, $3^{7-4}$, $3^{8-5}$, *etc.* in 27 runs and $5^{5-2}$, $5^{6-3}$, $5^{7-4}$, $5^{8-5}$, *etc.* in 125 runs have been developed in which all the main effects are linear trend-free. Here, $s^{k-p}$ fractional factorial experiment means a $\dfrac{1}{s^p}$ th fraction of $s^k$ full factorial experiment in $s^{k-p}$ runs.

**Mating-Environmental designs under two-way blocking setup**

Mating-Environmental Row-Column (MERC) designs for comparing test lines with a control line are suitable for breeding programmes as it provides designs which serve both the purposes, i.e. mating designs laid out using a row-column design, for the breeders. They facilitate comparison among general combining ability (gca) effects (both test lines and control line) free from specific combining ability (sca) effects. Methodology for orthogonal partition of the information matrix for estimating elementary contrasts pertaining to gca and sca effects for a diallel (or partial diallel) cross experiment laid out under a two-way blocking set up for test vs. control comparisons has been developed.

The following three series of MERC designs have been obtained that are variance balanced for estimating elementary contrasts pertaining to gca effects free from sca effects for comparing test lines with a control line:

- Series I: The parameters are number of crosses (v) $=\dfrac{t(t+1)}{2}$, number of rows (p) = number of columns (q) = number of lines (t), $r_1$ (replication of test versus test) =1 and $r_2$ (replication of test versus control) = 2.

- Series II: The parameters are

$$v = \frac{t(t+1)}{2}, \quad p = \frac{t(t-1)}{2}, \quad q = t, \quad r_1 \text{ (replication of}$$

test versus control) = t-1 and $r_2$ (replication of test versus test) = t-2, where t is an odd number.

- Series III: The parameters are

$$v = \frac{t(t+1)}{2}, \quad p = \frac{t(t-1)}{2}, \quad q = t, \quad r_1 \text{ (replication of}$$

test versus control) = t-1 and $r_2$ (replication of test versus test) = t-2, where t is an even number.

Developed SAS macro for the generation and randomization of the three series of MERC designs given above. Studied per cross canonical efficiency of MERC design as compared to an orthogonal design with same number of crosses. Catalogues of classes of MERC designs obtained has been prepared for t < 20.

### Experimental designs in the presence of indirect effects of treatments

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 class of complete block designs balanced for neighbour effects from left neighbouring unit is shown to be universally optimal for the estimation of direct and neighbour effects of treatments. Two series of universally optimal block designs under a non-additive model balanced for spatial indirect effect from one-sided neighbouring unit have been constructed. Further, universal optimality of block design with spatial indirect effect from neighbouring units on both sides under a non-additive model has also been established in the presence of interactions among the treatments applied in the adjacent plots. A class of complete, circular block designs balanced for effects from the neighbouring units with parameters v, b = $v^2$, r = $3v^2$, k = 3v, $\lambda = v - 1$ (every $v^3$ treatment combinations of left neighbour × direct × right neighbour appear a constant number of times) and $\mu_1$ = 3v (each ordered pair of treatments including identical pairs appear a constant number of times) has been shown to be universally optimal for the estimation of direct effects and neighbour effects (left and right) of treatments.

This class of designs has been shown to be robust against randomness of block effects.

Block model with spatial indirect effects from neighbouring units at distance two incorporating trend component has been considered and conditions for the block design to be trend free have been derived. A series of block design balanced for spatial indirect effects from neighbouring units at distance two with parameters v, b = v(v-1)/2, r = (v-1)(2v-1)/2, k = 2v-1 have been found to be trend free.

Block design with spatial effect from adjacent neighbouring units under a correlated error structure has been studied and a series of strongly balanced block designs with one-sided spatial effect from adjacent left neighbouring unit has been developed using balanced incomplete block design. A class of row-column designs balanced for non-directional spatial indirect effects has been obtained.

### Experimental designs for polycross trials

Polycross nursery is a specific type of field design to ensure random mating among the genotypes and is commonly used in the breeding of wind-pollinated species. In a polycross trial, each genotype gets an equal chance of pollinating, or being pollinated by, any of the others. A series of polycross designs for v genotypes (where v+1 is a prime number) in v/2 squares of size v each and each genotype replicated $v^2/2$ times, balanced for neighbours in eight directions, has been obtained. Another series of polycross designs for v genotypes (where v is an odd number) in v arrays of size (v+1)/2 x v each and each genotype replicated v(v+1)/2 times, balanced for neighbours in eight directions, has been developed.

Situations may arise in which some genotypes interfere the growth or production of other genotypes due to different maturity or plant height. Generally, for easy pollination, male (female) genotypes are not to be kept as neighbours to other male (female) genotypes. A method of constructing a class of neighbour restricted block designs suitable for polycross trials has been developed with parameters v (=2m) genotypes belonging to two groups each of size m, in v blocks having size 2v and each genotype replicated v times has been developed. When more number of genotypes is to be grown together, a larger experimental area is required for the same and hence chances are more

for having heterogeneity in two cross-classified directions in the nursery. Neighbour restricted row-column designs are advisable for such situations. Developed a general method of constructing a series of neighbour restricted row-column designs for polycross trials in v (=4m) genotypes with two groups having 2m genotypes each in m arrays of size 2 x v each and each genotype replicated v/2 times. Here, each genotype belonging to any one group has every genotype from the other group as neighbour 3 times.

Further, when the topography of the nursery is such that a known wind system in a certain direction may prevail, then designs balanced for neighbour effects of genotypes only in the direction of wind are appropriate which may help in saving experimental resources to a great extent. A series of polycross designs have been obtained 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.  The middle row in each array is the seed row while the other two rows act as border rows. Here, each genotype in the seed row has a chance to get pollinated by the 3 genotypes in its right side and if the wind is flowing from left to right, then each genotype in the seed row has a chance to get pollinated by the 3 genotypes in its left side. SAS Macros have been developed to generate these three series of polycross designs.

**Planning, designing and analysis of experiments planned on stations under the Project Directorate for Farming Systems Research**

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 and $3^2$ x 2 balanced confounded factorial experiments.

Analysis work for 220 experiments conducted during the year 2011-12 has been completed. Results have been tabulated in the form of summary tables and sent to the respective scientist-in-charge of the cooperating centres. The final tables of the results have been prepared and sent to PDFSR, Modipuram for inclusion in the project report of AICRP on IFS. Data for 180 experiments for the year 2012-13 have been received and is under the process of scrutiny. Documentation of data and preparation of data files for the experiment entitled "Long range effect of continuous cropping and manuring on soil fertility and yield stability" for five centres namely Karmana [1977-78 to 2009-10 (33 years)], Masodha [1977-78 to 2011-12 (35 years)], Rewa [1977-78 to 2011-12 (35 years)], Sirugguppa [1977-78 to 2011-12 (35 years)] and Ranchi [2004-05 to 2011-12 (35 years)] for rice grain and straw yield for both, kharif and rabi, seasons has been completed and replicated data has been converted into kg/ha for both the seasons. Net returns and calorific values have also been obtained for replicated and mean yield data for both the seasons. Mean yield for all the 19 treatments have been computed and percentage change in mean values for productivity of both the seasons has also been obtained. Pooled grain data on 5 yearly basis and percentage change in the yield, coefficient of variation and Standard errors over five years have been calculated for both the kharif and rabi crops separately. Different statistical analysis performed are trend analysis on grain yield on replicated data as well as five years pooled data; Multivariate Analysis of Variance for testing the significance of 18 treatment combinations, etc.

Expressions have been derived for computing least significant differences for pair-wise comparison of treatments of a split-split plot design with sub-sub plot treatments having factorial treatment structure used for a climate change experiment. SAS code for the analysis of data pertaining to this experiment was developed.

**Application of linear mixed effects model in bioacoustics: A novel non-invasion approach for efficient monitoring of health and productivity in dairy animals**

Data on four phases of estrous cycle namely Proestrus, Estrus, Metestrus and Diestrus of voice signal number, call duration, minimum amplitude, maximum amplitude, total energy, mean pitch, mean intensity, formant variables: F1 (Pharynx), F2 (Oral Cavity), F3

(Nasal Cavity), F4 (Sinuses – Singing Formant) and F5 (Noise to harmonic ratio) have been received for 7 subjects under study. Descriptive statistics (like mean, SD, SE, variance, minimum, maximum, mode, range, lower quartile, median, upper quartile, lower 95% CL for mean, upper 95% CL for mean and CV) have been computed for the various parameters separately for four phases of estrous cycle of all the subjects under study. Principal Component Analysis for the formant variables of the first, second, third and fourth phases of estrous cycle of the seven subjects under study has been performed using variance-covariance matrix option. To test the hypotheses about the equality of means, when the same dependent variable is measured over more than one occasion for each subject, the procedure of repeated measures analysis has been used through linear mixed effects model with compound symmetric structure using PROC MIXED in SAS software. It is observed that neither voice signals, interaction of animal and voice signals, interaction of oestrus cycle and voice signals are significantly affecting the formant F4 (sinuses/singing) nor pairwise voice signals are statistically different.

## Information System for Designed Experiments (ISDE)

Information System for Designed Experiments aims at centralized storage of designed experiments conducted in India and is an on-line information system available on http://www.iasri.res.in. Presently, information relating to databases on agricultural field experiments (excluding pure varietal trials) conducted in the country, on-farm and on-station experiments conducted under the Project Directorate of Farming System Research and Long Term Fertilizer Experiments conducted under the All India Coordinated Research Project on Long Term Fertilizer Experiments are stored and maintained on-line. As on March 31, 2014, Agricultural Field Experiments Database contains more than 35000 experiments on different crops and designs. Data relating to 1380 experiments have been entered on-line between 01.04.2013 and 31.03.2014.

Module for uploading excel datasheet of Randomized Complete Block design has been developed. Data can be entered directly through the keyboard as well as can be uploaded through an Excel worksheet. The screen of the form is given as:



Regarding integration of distinct databases, common scripts have been developed to generate report that supply details of experiments based on design used and index of experiments for all the other databases except Long Term Fertilizer Experiments. The details of crop-wise experiments from Agricultural Field Experiments can be retrieved as follows:



Clicking on **crop-wise** option gives a form as:



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Selection of **state** and **crop** and then clicking on Submit gives the following form:



Clicking on **Click to View** gives details of the experiments as given in the following snapshot:





## Planning, designing and analysis of "On Farm" research experiments planned under Project Directorate for Farming Systems Research

Three types of experiments viz. Response of nutrients, Diversification/Intensification of cropping system and On-Farm integrated farming system research are planned and conducted at 30 On Farm Centres (OFR) in farmers' field under Project Directorate of Farming Systems Research, Modipuram. The statistical analysis of Experiment-1 (Response of nutrients) conducted at 6 OFR centres and Experiment-2 (Diversification/ Intensification of cropping system) conducted at 2 OFR centres during 2011-12 has been carried out and summarized results were sent to PDFSR, Modipuram.

In Experiment-3 [Integrated Farming System (IFS)], different interventions have been incorporated in various modules of IFS with the objective to address critical constraints of small and marginal farmers for improvement in overall productivity, to increase the profitability of households and ensure livelihood security of the farmers. These modules are evaluated in terms of monetary returns and analysis has been carried out for 14 OFR centers. Using the input and out costs of intervention in various modules of IFS at Angul, (Orissa) OFR center, the impact of interventions in terms of profitability and productivity of farmers have been presented in the table below (2011-12).

Pairwise comparison of all modules was studied and difference of net returns before intervention and after

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**Interventions and returns from on-farm farming system modules in Eastern Plateau and Hill region**

| District (state): Angul (odisha) **NARP zone:** Mid Central, **No. of households:**12, **Average holding size:** 1.19 ha | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Farming System (FS) | Module (s) | Total gross returns (Rs) | Total cost of the module (Rs) | Return over variable cost from module (Rs) | Total returns over variable cost (Rs) | Cost of intervention (Rs) | Returns over variable cost from interven-tions (Rs) | Return over variable cost per rupee invested | Per day profit (Rs/day) | Household employment generation (man days) |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Existing FS (M$_0$) | Crop | 55345 | 29244 | 26102 | 26102 | - | - | - | 71.51 | 181 |
| | Livestock | 11383 | 7187 | 4196 | 4196 | - | - | - | 11.50 | 13 |
| | Optional | 56594 | 23137 | 33817 | 33817 | - | - | - | 92.65 | 36 |
| | Total | 123322 | 59568 | 63754 | 63754 | - | - | 1.07 | 174.67 | 230 |
| Improved FS | M1 | 60450 | 32,386 | 28064 | 28064 | 3142 | 1963 | 0.87 | 76.89 | 194 |
| | M2 | 13005 | 8,288 | 4717 | 4717 | 1101 | 521 | 0.57 | 12.92 | 18 |
| | M3 | 1233 | 879 | 354 | 354 | 879 | 354 | | | 2 |
| | M4 | 62041 | 22,912 | 39129 | 39129 | -225 | 5672 | 1.71 | 107.20 | 44 |
| | Total (M1 to M4) | 136729 | 64465 | 72264 | 72264 | 4897 | 8510 | 3 | 197.0 | 258 |

Mo: Existing farming system {Cropping sequence: Rice + Greengram, Rice+vegetable, Rice/arhar+maize, Rice+Sunflower, jute+rice, Maize+veg, Livestock: Cow (4), Bullock (4), Calves (2), Goat (4). Optional: value addition in fruits like mango}

M1: Intervention in crop {Rice: HYV..seed (lalat), application of Balanced fertilizer to rice 80:40:40 kg NPK/ha and zinc sulphate @25 kg/ha+ Chemical weed control inpaddy with butachlor, Pulses: Use of rhizobium and PMS in pulse, Adoption of IPM with use of pheromone, imidaclopid. Vegetable: HYV.veg. like (Tomato-Utkal Raja, Pointedgourd-swarna alokik), Balaced fertilizer applications with micronutrients

M2: Intervention in livestock {Cattle: fodder (2kg/day/ animal) and Supplementing feed with mineral mixture @ 15 gm/day + PPR vaccination & adminstrating albondazole + Shed cleaning with disinfectants like Phenyle, CaOCl$_2$ & CaCo$_3$ + AI of desi cows for CB calf. Goat: Crossing desi goat with improved breed}

M3: Intervention in value addition: {Ghee and cheese making, Pickle making from mango, Pickle and ketchup from tomato, Cleaning, grading & storing of greengram}

M4: Intervention in other priority farming system: {kitchen gardening+ Backyard poultry with banaraja+ Culture of fast growing fish species. with IMC and supplemental feeding+ Backyard poultry with banaraja dual purpose bird+ Intercropping of veg.in mango, orchard+ Stocking of quick growing species of fishes in composite pisci culture method}

interventions on all modules except optional were found to be statistically significant.

On line data entry of experiment -1 (Response of nutrients) conducted during 2012-13 has been done by OFR Agronomists and analysis of 24 experiments conducted at 20 OFR centres has been carried out. The data of 39 experiments (Diversification and/or Intensification of cropping system) conducted at 29 OFR Centres during 2012-13 has been processed for statistical analysis.

**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 after the completion of each crop cycle from cooperating centres for each season pertaining to the experiments were undertaken for six cooperating centres for the year 2011-12 and of two cooperating centres for the year 2012-13. Soil Quality Index (SQI) has been worked out for Parbhani Centre for the two consecutive years 2011-12 and 2012-13. The treatment T8 (100% NPK+ FYM @ 10 t/ha) gave the highest SQI followed by T3 (150% NPK), T5 (100% NPK+ ZnSO4 @ 25kg/ha). Minimum SQI was for the treatment T12 (Fallow) for both the years.

Data of Ranchi Cooperating centre for the period 1979-80 to 2010-11 (32 years) for Kharif (Soybean) and Rabi (Wheat) was analyzed using the linear mixed effects model with repeated measures. Treatments were different combinations of N, P, K and other micronutrients. Treatments, years and interaction i.e. treatment x year were found to be significant. For both Kharif and Rabi seasons, all the pairwise treatment comparisons were significant at 1% level of significance except for 100% NPK; 100% NPK + HW and 150% NPK. Least squares mean was maximum for 100% NPK + FYM followed by 100% NPK + Lime and 100% NPK + HW. Pairwise comparisons of years were found to be significant at 1% level of significance in most of the cases.

The effect of weather parameters on yield for all the ten treatments have been studied for Pantnagar cooperating centre for the period 1991-2008 by expressing the effects of changes in weather variables on yield in $w^{th}$ week as a linear function of respective correlation coefficients between yield and weather variables. The weather variables are minimum temperature, maximum temperature, sunshine and relative humidity during the period of crop. It was observed that effect of sunshine was significant for six treatments $T_1$ (50% NPK), $T_3$ (150% NPK), $T_4$ (100% NPK+HW), $T_5$ (100% NPK+ZINC), $T_6$ (100% NP), $T_7$ (100% N) while maximum temperature affected four treatments $T_3$, $T_8$ (100% NPK+FYM), $T_9$ (100% NPK-S), $T_{10}$ (Control) and minimum temperature affected three

treatments ($T_1$, $T_6$, $T_9$). Relative Humidity had no effect on any of the ten treatments. Data of six cooperating centres for the year 2010-11 and 2011-12 of yield, uptake and soil parameters have been uploaded on Information System on Designed Experiments.

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

**Forecasting agricultural commodity prices using time series data**

Agricultural production is characterized by risks and uncertainties largely due to uncertain yields and relatively low price elasticity of demand, of most commodities. Commodity price movements have a major impact on overall macroeconomic performance. Hence, commodity-price forecasts are a key input to macroeconomic policy planning and formulation. The price volatility in case of onion is considered to be notorious in India. It has been observed that price ballooning in case of onion many a times destabilized the popular democratic governments. This study has been undertaken to forecast onion prices before the crop arrival and particularly in the lean periods which witnesses high rise in onion price. The administration may find enough time period to readjust supply position of onions in order to avoid high price situation. The study has been illustrated with the time series data on daily spot price of onion in Delhi Azadpur Market from 01 January 2009 to 30 September 2012. This study was undertaken to obtain a suitable Generalized Autoregressive Conditional Heteroscedastic (GARCH) and Autoregressive Integrated Moving Average (ARIMA) models for forecasting onion prices. ARIMA (0,1,1) model gave reasonable and acceptable forecasts; it did not perform well when there existed volatility in the data series. GARCH (1,1) has also been used to forecast prices. The model performed better than ARIMA (0,1,1) because of its ability to capture the volatility by the conditional variance of being non-constant throughout the time. The GARCH (1,1) was concluded to be a better model than ARIMA (0,1,1) in forecasting price of onion because the values for Root Mean Squared Error (RMSE), Mean Absolute Error (MAE) and Mean Absolute Percentage Error (MAPE), calculated using this model were smaller than those calculated using ARIMA (0,1,1) model and also both the AIC and SIC values from GARCH model were

smaller than that from ARIMA model. Therefore, it shows that GARCH is a better model than ARIMA for estimating daily prices.

**Methodology for estimation of compound growth rate and its web-based solution**

Compound growth rate is generally estimated by assuming that the path of response variable can be described by monotonically non-decreasing nonlinear growth models, like Monomolecular, logistic and Gompertz models. The compound growth rate was estimated using Richards Model.

Study for estimating the unknown time varying trend of annual growth was carried out by *Time domain smoothing* approach. To this end, three methods viz. moving average, kernel smoothing and local linear smoothing were considered. Optimal bandwidth of kernel was obtained by developing iterative estimation procedure. Also compound growth rate was estimated by *State domain smoothing* approach. India's total food grain production was considered and by using fitted growth rate, estimated values of total foodgrain production time-series data was obtained. The average compound growth rate under state domain smoothing was calculated as 2.26% whereas MSE was calculated as 132.17 million tonnes. A user friendly software has been developed for estimating the compound growth rate (WebECGR) and the same has been uploaded at *http://iasri.res. in/cgr*. The compound growth rate was estimated for adoption of Bt cotton in India during the period 2002-03 to 2011-12 through Richards model using the WebECGR package developed.



Uploading of data into WebECGR package
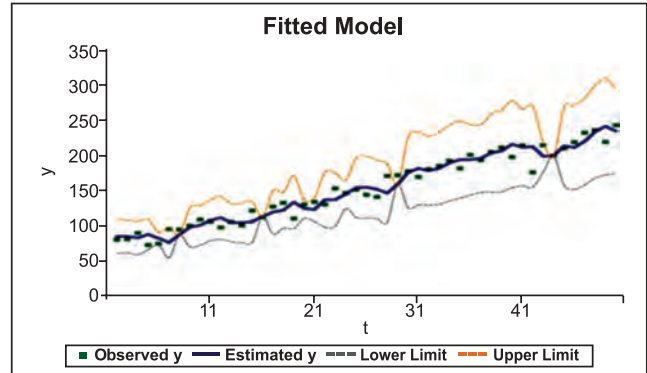


Fitted values of State domain smoothing of lag 1 model along with data points, Estimated Compound Growth Rate: 2.26%, MSE: 132.17 MAE: 8.79

**STAR and SV families of nonlinear time-series models for describing cyclicity and volatility in agriculture**

The ARIMA methodology may not be able to properly model many nonlinear time-series data such as oil sardine, Mackerel and Bombay duck landings data. In such situation, Exponential Smooth Transition Autoregressive (ESTAR) model can be applied. The procedure for estimation of parameters of ESTAR using Particle Swarm Optimization (PSO) technique was developed. The performance of fitted model was compared and it was concluded that ESTAR models perform better than ARIMA for the datasets under consideration.

**Modeling and forecasting of time-series with long memory process**

Presence of long memory has been tested in the wholesale price of pigeon pea in Amritsar and Bhatinda market as well as in Maximum, Minimum and Modal price of pigeon pea at All India level. All the five series showed the presence of long memory. Accordingly, Autoregressive Fractionally Integrated Moving Average (ARFIMA) model has been fitted for modelling and forecasting of wholesale price of above series. The long memory parameter has been estimated by GPH estimator (Geweke and Porter-Hudak, 1983), Gaussian Semi parametric estimator (Robinson, 1995) as well as by wavelet methodology (Jensen, 1999) using haar wavelet filter. Simulation study to compare different estimation procedures for estimating long memory parameter revealed that wavelet method is better than other methodology in terms of minimum mean squared errors criterion.

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

The trend in rainfall in India during the period 1901-2002 in four agro-climatic zones namely; Humid, Semi-arid temperate, Semi-arid tropic and the Arid zone have been analyzed using the non-parametric Mann-Kendall trend test and Wavelet methodology. No significant long term trend was observed for the Humid, Semi-arid temperate and Semi-arid tropic zones. Whereas, significantly increasing trend was observed for the Arid zone. Using the Discrete wavelet transforms (DWT), rainfall data for the period 1939-2002 was analyzed and the trend for all the four zones were found to be statistically significant. Some significant structural breaks have also been found in mean temperature in different agro-climatic zones of India.

**An econometric study of water markets in canal command area of North-Western Rajasthan**

North-Western region of Rajasthan witness impressive development of canal irrigation and agriculture in the past decades. Water markets are also emerging on account of shortage of canal water and saline groundwater. Structure and determinants of water markets and their impact on efficiency, equity and reliability on farm economy in the said area was examined using primary data collected from the selected farmers for the Agricultural Year 2011-12. Tabular analysis, exponential growth model, linear regression, logit model, the analysis of variance with post-hoc test and stochastic frontier production function were employed. The growth in groundwater irrigation was found impressive in the region in spite of meager area of underground irrigation, In terms of volume, the groundwater development remained almost same during 2004-09. However, there was an improvement in water table in the study area. Nearly half of the farmers used canal as well as diesel tubewell and one-third used canal only for irrigation. Half of the total farmers were purely self users of irrigation water and one-third were self-users+buyers followed by self-users+sellers. Diesel tubewells are the main source for selling water and most of sellers were from small, semi-medium and medium farmers. Logistic regression showed that proportion of area under cash crop, education, off farm income, owned land and distance from the canal were significant factors which affected the tubewells' installation decision of farmers. The decisions of farmers to buy water were found to be influenced by selling price, tubewells' horsepower per ha, number of fragment per farm and own land holdings significantly. It is interesting to note that farmers' with both sources of irrigation, either owners or buyers preferred to grow cash crops on more land in comparison to farmers with canal irrigation only. Analysis of frontier production function showed the presence of significant inefficiencies in the production of cotton, wheat and all crops. In wheat about 85 per cent of the difference between observed and frontier output was mainly due to the inefficient use of resources which are under the control of farmers. Most of the tubewells were operated by tractors/engines. The groundwater markets were inefficient as selling price were quite high in comparison to total cost of water extraction. Reliability of canal irrigation in terms of adequate availability and control on water supply were found to be poor for buyers as well as self-users. For sustainable development of irrigation water and its equitable and efficient management to ensure livelihood security of farming community in long run, there is a scope for monitored groundwater development and efficient water markets to benefit small and marginal farmers. Further, the subsidy on water saving technology like underground pipeline may be extended and farmers should be educated for better utilization of resources to increase the resource use efficiency.

**Study on population dynamics of insect pests and diseases (Bt Cotton)**

Population dynamics of insect pests and diseases (Jassids, Whitefly, Mirid bug, Thrips, American Bollworm larva, Spotted Bollworm larva, Pink Bollworm larva, Spodoptera, Mealy bug, Cotton leaf disease, Aphid, Grey mildew, Parawilt and Red leaf) for 13 centres was compiled. Weather data on temperature (maximum and minimum), relative humidity and total rainfall have been utilized for model fitting. Correlation of weather parameters with pest count was estimated and tested for stationarity using ADF test. The following Auto regressive model with external input (ARX), was fitted to pest data (jassid at Faridkot centre):

$$Y = C(1) + C(2)*MINT(-1) + C(3)*MINT(-2) + [AR(1)=C(4)]$$

where, Y is the square root of pest count per three

leaves, mint is minimum temperature and C(1), C(2), C(3), C(4) are constants. ARX model was best fit for Jassids at Rajpura centre. It was observed that sucking pests are becoming serious pest of cotton among insect pests whereas the bollworms especially American Bollworm and spotted Bollworm have reduced to traces.

**Robustness of sequential testing procedures on some distributions used in agricultural pest control**

Developed sequential probability ratio test for size-biased negative binomial distribution. The developed test applied on mustard aphid count data as an alternative to zero-truncated problems. Estimating equations were also developed when the known parameter has undergone a change. Sequential testing procedures were also constructed for a family of continuous distributions. Empirical investigations were carried out in order to study the sensitivity of the developed sequential testing procedures when the known parameter has undergone a change. The constructed sequential testing procedures were also applied on real data set and estimated average sample number required for conducting subsequent sequential testing experiment.

**Forecasting models using functional data analysis and nonlinear support vector regression techniques**

Yield and price forecasting models have been developed to estimate the probable outcomes of uncertain factors. Forecasting models using Functional Principal Component Analysis (FPCA) methodology has been compared with the forecasting models developed earlier for wheat yield data (1984-85 to 2010-11), Ludhiana based on weather parameters. It was found that performance of FPCA methodology was superior to other methodologies for the data under consideration. For price forecasting, a futures-based model was developed which predicted a cash price from futures price and commodity basis. The focus was on forecasting the commodity basis rather than the cash price because of the availability of futures price information and the low uncertainty associated with commodity basis. A model-based approach was adopted to estimate the density function of the commodity basis distribution. Finally, price forecasting technique was developed using Functional Cluster Analysis methodology. The methodology has been

applied to predict commodity basis which is a function of cash price and future price. Using commodity basis, cash price of Soybean (Rs/Kg) of Indore market was predicted.

Crop yield prediction model was developed using Nonlinear Support Vector Regression (NLSVR) technique and illustrated for predicting maize crop yield. As an illustration, maize crop yield data as response variable and total human labour, farm power, fertilizer consumption and pesticide consumption as predictor variables were considered. Performance of a fitted model was assessed in terms of Root mean square error (RMSE), Mean absolute error (MAE) and Mean absolute prediction error (MAPE). STATISTICA software package was used for carrying out data analysis. Superiority of NLSVR technique over artificial neural network technique was demonstrated for the data under consideration. It was concluded that NLSVR methodology was quite successful for modelling as well as prediction purposes

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

**Spatial nonstationarity in small area estimation under area level model**

When only aggregated level data is available, the empirical best linear unbiased predictor (EBLUP) under Fay–Herriot model is widely used method of Small Area Estimation (SAE). However, this method does not account for the presence of spatial nonstationarity in the data. There are situations where the relationship between study variable $y$ and the covariates $x$ is not same over the study area, this phenomenon is referred to as spatial nonstationarity. The spatial nonstationarity is very common phenomenon in agricultural and environmental data. A geographically weighted pseudo empirical best linear unbiased predictor (GWEBLUP) under area level model was developed with geographical weighted regression approach to model spatial nonstationarity. The SAE methodologies (EBLUP and GWEBLUP) have been applied to produce district level model based estimates of crop yield for paddy in the State of Uttar Pradesh using the data on crop cutting experiments supervised under Improvement of Crop Statistics scheme of National

Sample Survey Office (quality data collected with much reduced sample size) and secondary data from the population census.
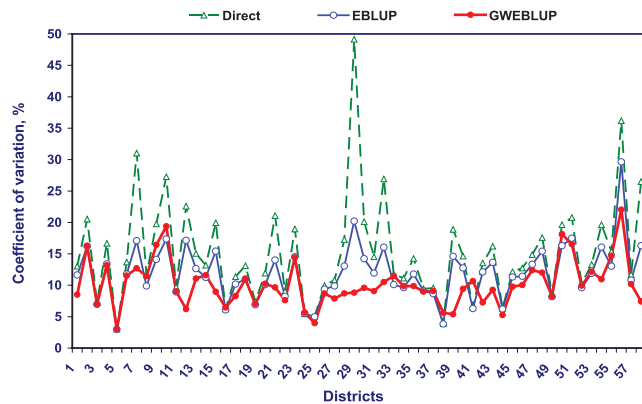


Fig. 1. District-wise coefficient of variation for different estimates.

The results showed a considerable gain in precision in model based estimates produced by applying SAE (EBLUP and GWEBLUP). The model based estimates obtained by accounting the spatial nonstationarity (GWEBLUP) in the data were more efficient than the one obtained by ignoring this information (GWEBLUP). However, both of these model based estimates were more efficient than the direct survey estimate. District wise coefficient of variations is shown in Fig. 1. In many districts there was no survey data and therefore it was not possible to produce direct survey estimates for these districts. The model based estimates generated for such districts using SAE were still quite reliable and the regions can be used for effective policy formation.

### Study of sample sizes for estimation of area and production of food grain crops

In India, estimates of yield rates of principal food and non-food crops are obtained on the basis of crop cutting experiments conducted in majority of States/UTs under the National Programme of Crop Estimation Survey (CES). At present, over 95 per cent of the production of food grains is estimated on the basis of yield rates obtained from the crop cutting experiments conducted on scientific basis spread over 29 States /UTs.

In view of the seriousness of the issues relating to the data quality aspects of crop estimation surveys, the DAC, Ministry of Agriculture constituted a committee under the Chairmanship of Prof. A Vaidyanathan, the committee in its report made suggestions regarding sample size needed for crop area and crop yield

estimation at State/ National level. The proposed study has been undertaken with a view to determine sample size needed for estimation of area and yield for different crops at State/National level.

The main finding in this study was that on the basis of smaller sample sizes, the estimates of average yields of paddy and wheat crops may be estimated with suitable degree of precision in number of States. However, for other crops, these sample sizes may not be adequate for estimating the average yield. There is a need to increase the sample sizes appropriately for precise estimation.

### Farm power machinery use protocol and management for sustainable crop production

A comprehensive assessment of mechanization and agricultural machinery manufacturing/supply scenario was done in Uttar Pradesh, Punjab, Haryana and Rajasthan states. To accomplish this, guidance was provided pertaining to various aspects including sampling design, sample size and data collection related issues, designing of schedules for primary data collection and data analysis as per the proposed sampling design. A web based expert system for efficient farm power-machinery selection and management for selected cropping systems is being developed. Programming language C# with ASP.NET technology is being utilized. The Frontends forms for Farmer's Profile, Details of Various Crops, Machinery Related Information, Crop Production Information, Field Efficiency and Field Capacity have been designed and developed.

### An alternative methodology for estimation of cotton production

The estimates of cotton production are currently being released by the two different agencies. The official estimates are released by Directorate of Economics and Statistics (DES), Ministry of Agriculture while the trade estimates are released by Cotton Advisory Board (CAB) in consultation with Cotton Association of India (CAI), Confederation of Indian Textile Industry (CITI) and Cotton Corporation of India (CCI). In view of the divergence between the two set of estimates, a study entitled "Study to investigate the causes of variation between official and trade estimates of cotton production" was undertaken by IASRI which was funded by DES, Ministry of Agriculture (MoA), Govt. of

India. It was felt to develop an alternative methodology for estimation of cotton production on the basis of limited number of pickings. An alternative procedure using double sampling technique was proposed. The proposed methodology was tested using secondary data acquired during previous study for five districts namely, Adilabad, Warangal, Guntur, Karimnagar and Khammam of Andhra Pradesh (A.P.) state and for five districts namely, Jalgaon, Yavatmal, Aurangabad, Jalna and Buldhana of Maharashtra. It was observed that in case of double sampling approach, the estimate of average yield of cotton is obtained with less than 5% standard error at district level except one district which is fairly reliable. The estimate is almost at par with the estimate obtained using existing General Crop Estimation Surveys (GCES) procedure. It was also observed that the percentage reduction in cost is between 59.1% to 73.9%. The secondary data available for testing the developed procedure in both the states is the crop cutting experiments (CCE) data. The sampling design followed for CCEs in both the states is stratified three stage random sampling. Keeping in view the assumption in the above proposed double sampling approach that the sample of crop-cut fields covered under GCES scheme is a simple random sample from the entire population of fields under cotton in the district, an alternative methodology using double sampling procedure under stratified two stage sampling design framework was proposed. But the proposed double sampling technique under stratified two stage sampling design framework requires CCE data from two additional fields from the selected CCE villages besides CCE data from two fields of the same selected village. Such data was only available for Jalgaon district of Maharashtra for the year 2006-07 and hence the proposed procedure was tested for this district. It was observed that the estimate of average yield of cotton is obtained with less than 3% standard error for Jalgaon district which is fairly reliable. The estimate is almost at par with the estimate obtained using existing procedure. It was also observed that the percentage reduction in cost is 43.66%, 51.88% and 59.27% for different values of preliminary sample villages i.e. 40%, 30% and 20% respectively that is very significant reduction in cost.

In order to validate the proposed double sampling procedure under stratified two stage sampling design framework, primary data collection was done in two districts namely, Aurangabad and Amravati of Maharashtra and two districts namely, Guntur and Warangal of A.P. It was observed that in case of both the proposed alternative procedures using (i) Double sampling regression procedure under stratified two stage sampling design framework under new set up i.e. when there is sub-sampling at second stage also and (ii) Double sampling regression procedure under stratified two stage sampling design framework under existing set up i.e. when there is no sub-sampling at second stage, the estimate of average yield of cotton was obtained with less than 4% standard error for three districts and less than 7% standard error for Warangal district which is fairly reliable. The estimates were found to be almost at par with the estimate obtained using existing procedure. The percentage reduction in cost in case of double sampling regression procedure under stratified two stage sampling design framework under new set up was found upto 83.14% whereas in case of double sampling regression procedure under stratified two stage sampling design framework under existing set up was upto 87.12%.

The average yield of cotton can be estimated with less than or equal to 7% standard error, if 81 preliminary sample villages are selected for third picking and 25 sub-sample villages are selected for the remaining pickings from each selected district. Therefore, the recommended sample size i.e. number of preliminary sample villages and sub-sample villages to be selected from a district are 81 (eighty one) and 25 (twenty five) respectively with minimum two sub-sample villages per mandal/ taluka of the district. In view of the above, it is recommended that the alternative sampling methodology using double sampling regression procedure under stratified two stage sampling design framework when there is no sub-sampling at second stage may be adopted in all the cotton growing states of the country for estimation of average yield of cotton which will not only provide reliable estimate of average yield of cotton and will save significant cost of the survey but will also be operationally more convenient than the GCES procedure and will reduce the workload of the field staff significantly. The Principal Advisor, DES, Ministry of Agriculture, Govt. of India was of the opinion that the developed alternative sampling methodology by IASRI will be adopted in all the cotton growing states of the country with effect from next harvesting season.

**A study on calibration estimators of finite population total for two stage sampling design**

Auxiliary information on the finite population is often used to increase the precision of estimators of finite population total or mean or distribution function. The ratio and regression estimators are some examples of estimators which makes use of auxiliary information at the estimation stage. The calibration techniques developed by Deville and Sarndal (1992) provides a reasonable approach of incorporating auxiliary information. Usually in large to medium scale surveys the most commonly used design is two-stage or multistage sampling. Most of the work related to calibration estimation is restricted only to uni-stage or two phase sampling design. Hence, there is a need to extend the procedure of calibration estimation in two stage sampling design. Thus, several calibration estimators of the finite population total under two stage sampling design in the presence of complex auxiliary information were developed. The variance and estimators of variance of the proposed estimators have also been developed. A higher order calibration estimator using the method of Singh *et al.* (1998) was proposed to improve the precision of the estimator of variance of the proposed calibration estimators. Further, calibration estimators were developed for the situation when population level auxiliary information was not available at the psu and ssu level using two stage two phase sampling design. The result of empirical study revealed that low level calibration approach based estimators under two-stage sampling design were better than the usual Horvitz Thompson estimator under two-stage sampling design. The results of empirical study also revealed that the higher order calibration estimators were also efficient.

**Impact assessment of agroforestry model in Vaishali district of Bihar**

The aim of this work was to assess the impact of introduction of Poplar tree based agroforestry in Vaishali district by the Forestry Research and Extension Centre (FREC), Patna as part of the project entitled "Integrated Community Based Forest Management Project in Bihar" funded by Planning Commission, Govt. of India on the socio-economic status of farmers of the district. In order to assess the impact, the total number of survived poplar trees in the district was estimated first, followed by the estimation of average income per household for poplar growing and non-poplar growing farmers of the district. The impact was also assessed with respect to current socio-economic condition of farmers of the district belonging to three different categories viz. (i) poplar households of adopted villages, (ii) non-poplar households of adopted villages and (iii) households of non adopted villages. The sampling design proposed for estimation of total number of poplar trees in the district was stratified cluster sampling treating blocks as strata and villages within each stratum as clusters. In order to estimate average income per household, the sampling design adopted for the survey was stratified two stage sampling treating blocks as strata, villages within each stratum as first stage units and households or farmers within each selected village as secondary stage units. Estimation procedure for obtaining district level estimates of number of agroforestry trees and average income per household per year were proposed as per proposed sampling design.

The number of poplar trees and total number of agroforestry trees estimated in the district are 18,43,848 (Eighteen lakh forty three thousand eight hundred forty eight) and 25,39,007 (Twenty five lakh thirty nine thousand seven) with percentage standard errors 0.18 and 0.15 respectively. The estimates of average income per household per year for different income variables, average expected income per household per year from poplar trees, agriculture plus poplar trees, reduced income from agriculture plus poplar trees, poplar trees per hectare, agriculture plus poplar trees per hectare, reduced income from agriculture with poplar trees per hectare and agriculture with poplar trees plus poplar trees per hectare along with their standard error were obtained using the proposed estimation procedure. These estimates were obtained with less than 10% standard error in most of the cases and hence the obtained estimates are reliable.

It was found that average family income per household per year of the three different categories viz. (i) poplar farmers of adopted villages, (ii) non-poplar farmers of adopted villages and (iii) farmers of non adopted villages, was found to be Rs. 3,73,379/-, Rs. 1,68,099/- and Rs. 1,14,279/- respectively. This shows that the average family income per household per year of poplar farmers of adopted villages is much higher in comparison to the non-poplar farmers of adopted

and non adopted villages which in turn shows the impact of agroforestry on farmers' income. The socio economic condition of the farmers in the district was assessed based on the data analysis of the primary data collected during the survey from a sample of 330 poplar farmers and 132 non-poplar farmers of selected adopter villages and 140 farmers of non adopter villages of the district.

Based on this impact study, it has been found that agroforestry has a great impact on socio-economic condition of the farmers of Vaishali district of Bihar and it is recommended that the same Poplar based agroforestry model may be implemented in all the districts of Bihar in particular and all the states of the country in general for over all socio-economic development of farmers of the country.

## Small area estimation for skewed data

Decentralized system of planning is a commonly observed phenomenon now-a-days. In view of scarcity of resources, the administrators and policy planners would like to ensure that resources are targeted effectively and efficiently to the areas most in need. For evaluation of the success of this targeting at a local level, reliable small area statistics is needed. As a result, Small Area Estimation (SAE) has now become the most important objective of almost every sample survey. Commonly used methods of SAE are based on assumption that a linear mixed model can be used to characterize the relationship between the survey variable Y and an auxiliary variable X in the small areas of interest. However, SAE based on linear mixed models can be inefficient when the underlying relationships are non-linear. A SAE technique for skewed data was developed that can be modelled linearly following a non-linear transformation, in particular, logarithmic transformation. An efficient estimator (referred to as Empirical Best Predictor (EBP)) of small area means for skewed data has been developed. The developed EBP method of SAE requires a back transformation bias correction. The bias correction due to back transformation has been done using Taylor approximation. A methodology of mean squared error (MSE) estimation for the EBP was also developed. This was achieved through development of MSE of EBP and then an approximately unbiased estimate of this MSE was developed. The developed methodology was found to be efficient than the existing methods of SAE for skewed data.

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

The methodology developed for estimation of quantitative harvest and post harvest losses of major crops/commodities during previous study has been applied for conducting large scale survey in the country and presently it is in operation. Sampling frame for selection of districts, blocks and villages for the study was prepared and guidance was provided for selection and finalization of the blocks and villages of all 120 selected districts under the study. The training for primary data collection and enquiry based and observation based data entry software was imparted to the Research Engineers and Principal Investigators under AICRP on Post Harvest Technology (PHT). The updation of enquiry based and observation based data entry software was done. The thematic maps depicting Agro-climatic zone wise highest post harvest loss for important crops during the previous study were prepared.

## Calibration estimator for finite population mean in the presence of non-response under two-stage sampling design

In large (or medium) scale surveys often the sampling frame of ultimate stage units is not available and the cost of construction of the frame is very high. Further, the population elements are scattered over a wide area resulting in a widely scattered sample. Therefore, not only the cost of enumeration of units in such a sample may be very high, the supervision of field work may also be very difficult. For such situations, two-stage or multi-stage sampling designs are very effective. In addition, it is also the case that information is not obtained from all the units in surveys. The problem of non-response persist even after call backs. The estimates obtained from incomplete data may be biased particularly when the respondents differ from the non-respondents. Accordingly efficient estimator were developed for estimation of population mean in the presence of non-response under two-stage sampling design. In particular, three different cases of nonresponse were considered and efficient estimators were developed for finite population total.

**Calibration approach for estimating population total with sub-sampling of non-respondents under single and two-phase sampling**

Non-response is a common problem in sample surveys. When such situations exists, the resulting estimates may be biased particularly when the respondents differ from the non-respondents. Besides, sampling variance of estimates may increase as the effective sample size is reduced. To address the problem of bias, Hansen and Hurwitz (1946) proposed a technique essentially to adjust for non-response. Using the calibration approach, the Hansen and Hurwitz (1946) technique based estimator was developed for the situation where the information on auxiliary variable is assumed known for the entire population units. The double sampling case has also been dealt with. The expression for variance and variance estimators were developed. The empirical results demonstrated that the proposed calibration approach based estimators outperformd the Hansen and Hurwitz (1946) estimator.

**Agricultural Research Data Book (ARDB)**

Agricultural research is a vital input for planned growth and sustainable development of agriculture in the country. Indian Council of Agricultural Research, being an apex scientific organization at national level, plays a crucial role in promoting and accelerating the use of science and technology programmes relating to agricultural research and education. It also provides assistance and support in demonstrating the use of new technologies in agriculture. 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) 2013, which is the Sixteenth in the series, is an attempt to put together main components/indicators of such information. The Data Book comprising 171 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 and Produce Management; Export and Import; India's Position in World Agriculture; Investment in Agricultural Research & Education; and Human Resources under National Agricultural Research System (NARS). This edition contains the latest information / data as available in the country

by the end of June, 2013. In ARDB 2013, some value editions 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 and 2012 (fifteenth edition).

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

**Establishment of National Agricultural Bioinformatics Grid in ICAR (NABG)**

This project is in operation under NAIP Component 1. It has five domain institutions i.e. NBPGR, New Delhi, NBAGR, Karnal, NBFGR Lucknow, NBAIM Mau and NBAII, Bangalore. The first supercomputing hub for Indian Agriculture ASHOKA (Advanced Super-computing Hub for OMICS Knowledge in Agriculture) has been established at Centre for Agricultural Bioinformatics (CABin), IASRI. A number of databases and tools have been developed and 51 training programs/ workshops/meetings of different domains were organized to sensitize and train researchers in the field of computational biology and agricultural bioinformatics wherein 800 researchers participated.

**First whole genome based microsatellite DNA marker database of tomato for mapping and variety identification: TomSatDb**

Traditionally, characterization of varieties is based on phenotypic observation but it is very difficult to distinguish varieties with very similar morphological characteristics and identification of the cultivars accurately is essential for maintaining cultivar integrity and Plant Breeders' Rights. In an era of IPR, the new variety can be identified based on allelic variation among varieties supplementing DUS test and product traceability. Tomato MicroSatellite

Database (TomSatDb), the first whole genome based microsatellite DNA marker database of tomato, houses a total of 146602 STR markers, mined in-silico, using MIcroSAtellite (MISA) tool. To cater to the customized needs of wet lab, automated primer designing tool is added. TomSatDB (http://webapp.cabgrid.res.in/tomsatdb/), a user-friendly and freely accessible tool offers chromosome wise as well as location wise search of primers. It is an online relational database based on "three-tier architecture" that catalogues information of microsatellites in MySQL and user-friendly interface developed using PHP.

These markers are expected to pave the way of germplasm management over abiotic and biotic stress as well as improvement through molecular breeding, leading to increased tomato productivity in various parts of the world. Apart from abiotic stress, there are more than 200 tomato diseases caused by pathogenic fungi, bacteria, viruses and nematodes

affecting tomato productivity as biotic stress. In order to manage the germplasm in abiotic and biotic stress with desired productivity such closely linked DNA markers are imperatively needed. Further economically and commercially important genes can be used for markers assisted introgression especially in new variety development programme. These findings can be of immense use in tomato genomics research in endeavor of tomato improvement and variety management at global level.

**Goat Microsatellite database (GoSatDb)**

A web based relational database has been developed consisting of 865210 microsatellite markers present in the whole genome sequence of goat. GoSatdb allows microsatellite search using multiple parameters like microsatellite type simple (90.42%) and compound (9.58%), repeat types viz. mono (62.28%), di (22.20), tri (11.72), tetra (1.55), penta (2.21) and hexa (0.04%) nucleotide, copy number, microsatellite length, pattern of the repeat motif itself and the location of the marker on the chromosome. Microsatellites can be retrieved by specifying the chromosome number (or

numbers). The database also searches the specified number of markers in a provided location range on a particular chromosome. The nucleotide sequences of the particular marker are also provided to facilitate primer designing for PCR amplification of any desired microsatellite. It is available at http://webapp.cabgrid. res.in/goat/ for users.

## Webserver for goat breed identification using molecular data

Identification of true to breed type animal for conservation purpose is imperative. Breed dilution is one of the major problems in sustainability except cases of commercial crossbreeding under controlled condition. Breed descriptor has been developed to identify breed but such descriptors cover only "pure breed" or true to the breed type animals excluding undefined or admixture population. Moreover, in case of semen, ova, embryo and breed product, the breed cannot be identified due to lack of visible phenotypic descriptors. Advent of molecular markers like microsatellite and SNP have revolutionized breed identification from even small biological tissue or germplasm. Microsatellite DNA marker based breed assignments has been reported in various domestic animals. Such methods have limitations viz. non availability of allele data in public domain, thus each time all reference breed has to be genotyped which is neither logical nor economical. Even if such data is available, computational methods need expertise of data analysis and interpretation. The first goat breed identification server developed using microsatellite DNA markers has been developed and made available at http://cabin.iasri.res.in/gomi/.

The data considered in the study was genomic DNA, isolated from blood samples using SDS-Proteinase-K method from 1037 unrelated animals belonging to twenty two different Indian goat breeds, selected from diverse geographical regions and climatic conditions with varying utilities and body sizes. 51850 allelic data was generated on 25 microsatellite loci based DNA fingerprinting on these goat breeds. Various statistical classifiers were applied and the best performing classifier selected after model evaluation criteria (viz., sensitivity, specificity, precision or positive predictive value (PPV), negative predictive value (NPV), accuracy, false discovery rate (FDR) and Mathew's correlation coefficient (MCC)) and implemented on

the web with the aid of CGI-Perl scripts, Hyper Text Markup Language (HTML), Java Scripts and launched using Apache.

Bayesian Networks was found to be the best classifier with highest accuracy of 98.7% using 51850 reference allele data generated by 25 microsatellite loci on 22 goat breed population of India. The FST values in the study were seen to be low ranging from 0.051 to 0.297 and overall genetic differentiation of 13.8%, suggesting more number of loci needed for higher accuracy. Higher number of loci is required due to less differentiable population and large number of breeds taken in this study. This server will reduce the cost with computational ease. This methodology can be a model for various other domestic animal species as a valuable tool for conservation and breed improvement programmes.

## Cattle breed identification server

Domestic cow, *Bos taurus indicus* is one of the important species selected by humans for various traits, viz. milk yield, meat quality, draftability, resistance to disease and pests and social and religious reasons. Since cattle domestication from Neolithic (8,000-10,000 years ago) today the population has reached 1.5 billion and it is likely to be 2.6 billion by 2050. High magnitude of numbers, breed management, market need of traceability of breed product, conservation prioritization and IPR issues due to germplasm flow/exchange, has created a critical need for accurate and rapid breed identification. Since, ages the defined breed descriptors has been used in identification of breed but due to lack

of phenotypic description especially in ova, semen, embryos and breed products molecular approach is indispensable. Further the degree of admixture and non-descript animals characterization, needs of molecular approach is imperative. Breed identification methods based on molecular data analysis has great limitations like lack of reference data availability and need of computational expertise. To overcome these challenges a web server was developed for maintaining reference data and breed identification. The reference data used for developing prediction model were obtained from 8 cattle breeds and 18 microsatellite DNA markers yielding 18000 allele data. Various algorithms were used for reducing number of loci or for identification of important loci. Minimization of up to 5 loci was achieved using memory-based learning algorithm without compromising with accuracy of 95%.This model approach and methodology can play immense role in all domestic animal species across globe in breed identification and conservation programme. This can also be modelled even for all flora and fauna to identify their respective variety or breed needed in germplasm management. This server is available at http://cabin.iasri.res.in/biscattle/.

### Indian genome submission portal

The various studies conducted by agricultural scientists, generate massive data related to biological information of plants, animals, insects, microbes and fisheries. They are dependent on NCBI, EMBL, DDBJ and other portals for their sequence submissions. The various limitations imposed on these sites and the poor connectivity problem prevents them to conduct their

studies on these open domain databases. A secured genome submission portal has been developed with a backend database following standard database management concepts (http://nabg.iasri.res.in). This initiative has been taken to build indigenous genome database and analysis platform in the country. Advanced hardware resources and parallel computing facilities have been installed for high speed information processing and knowledge extraction from this database. The database design has been made generic to integrate numerous genomic databases developed by agricultural scientists working in the area of bioinformatics. This portal is now open for users for submitting their sequences. Auto-curation program is being developed for management of data quality. There is need to encourage our researchers to make use of this portal by building confidence through providing security about their data, sharing the data for extracting knowledge for improving the technology and agricultural productivity. The sequence submission flow of the portal has been shown in the figure.
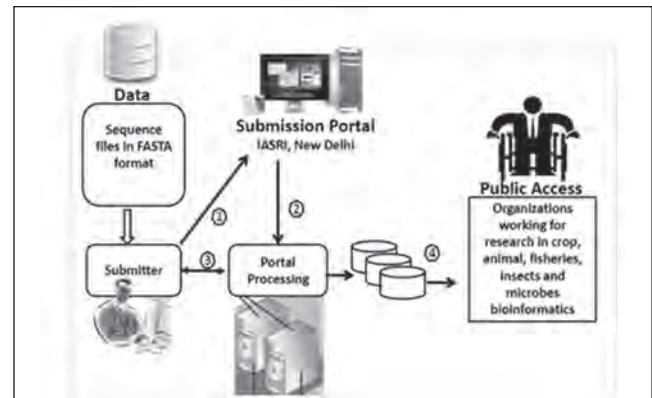


Sequence Submission Flow

### National agricultural bio-computing portal

National Agricultural Biocomputing portal provides a single point of access to High Performance Computing (HPC) resources. The portal provides an environment to carry out the bioinformatics tasks. The portal facilitates the user in submitting and managing application specific jobs. The jobs submitted through the portal are scheduled and resources are allocated through the Resource Manager. The Resource Manager deals with the access, allocation and management of resources and the execution of tasks. The users can manage the input and output data through the portal interfaces. The users have to login into the portal using the

User's login to access the facilities of the portal such as job submission, job status tracking and view output/ error data. It provides a web interface for submitting and monitoring jobs with the specific parameters. The sequential and parallel application jobs can be submitted through the portal. The grid provides its users with an environment possessing enormous computing power and large volumes of data and comprising of a large number of systems or resources.



The resource directories are used to retrieve the information about the state, configuration, and status of the grid resources. Round the clock helpdesk support is also made available to address the issues related to operational management of this facility. Different set of automation tools are configured to manage these computational resource. The portal will support computational requirements of the biotechnological research in the country. This will also bridge the gap between genomic information and knowledge, utilizing statistical and computational sciences. This will further help in establishing the large genomic databases, data warehouse, software tools, algorithms, genomic browsers with high end computational power to extract information and knowledge from cross-species genomic resources.

**Identification and characterization of salinity stress responsible genes in Sorghum bicolor**

Sorghum (Sorghum bicolor L. Moench) is the fifth major cereal crop in the world. Sorghum is one of the few resilient crops that has adapted well to changing climatic conditions such as drought, soil salinity, and high temperatures. All of these traits make it an ideal species to study the functional genomics of C4 plants.
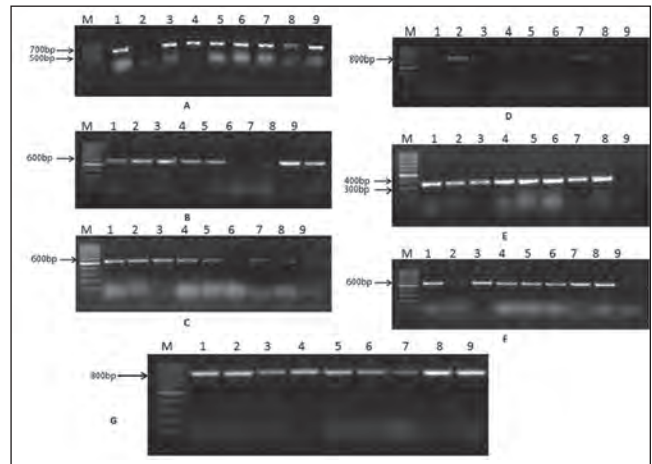


PCR amplification of seven salinity stress responsive genes from nine *Sorghum* genotypes
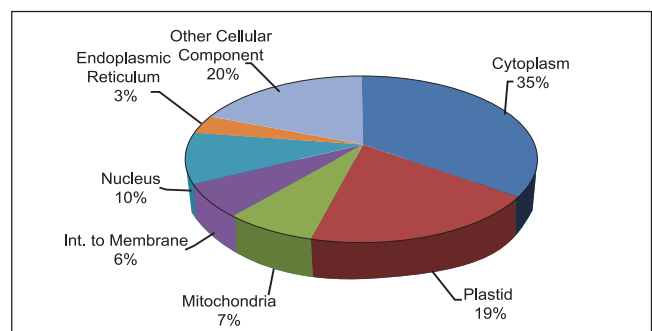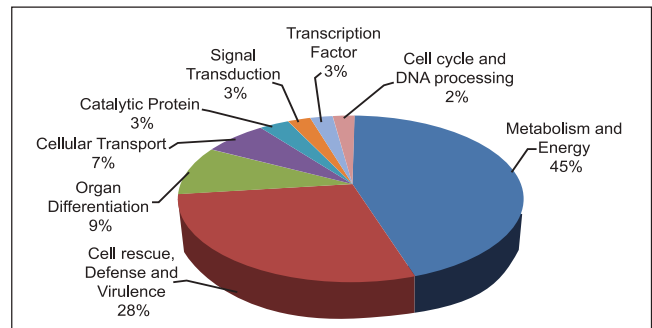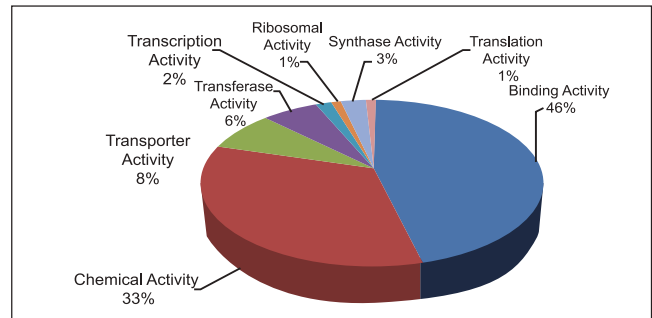


Distribution of GO terms in the Molecular Function, Biological Process and Cellular Component category

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Sorghum is moderately salt-tolerant crop and different genotypes show different levels of tolerance. Therefore, the present work emphasises on reconstruction, validation and annotation of salt stress genes of Sorghum. In order to identify genes responsible for salt stress in sorghum, expressed sequence tags (ESTs) were mined from the web resources. The downloaded ESTs were clustered and assembled into contigs and biological functions were obtained to most of the contigs through Gene Ontology (GO). The remaining contigs were mapped on sorghum genome and full length gene sequences were obtained by in-silico approach. These candidate genes were further validated by means of molecular techniques in nine Sorghum cultivars.

The study claims the possible involvement of the predicted genes in salt stress mechanism and may be useful in molecular breeding programme in Sorghum salinity research.

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

Heat shock protein 70 (Hsp70) is a chaperone and plays an important role in protein folding, translocation, macromolecular and complex remodeling reactions in camel (*Camelus dromedarius*) physiology. The most important function of Hsp70 is to protect the camel cells from heat-induced apoptosis which in turn help camel to survive in high temperature conditions. Hsp70 protein has 44kDa N-terminal nucleotide binding domain (NBD) and 26kDa C-terminal substrate protein binding domain (SBD). The function and expression of Hsp70 depends on allosteric mechanism of protein, which is well known in humans. This mechanism is executed when an ATP binds with NBD and the affinity of substrate binding to SBD gets decreased. Further hydrolysis of ATP promotes the binding of substrate (polypeptide segments) in the SBD. Till date, there exists no X-Ray-crystallography or NMR structure of Hsp70 in camel. Keeping this in view, two models of Hsp70 of Indian camel and their inter domain communication mechanism that occur through hydrolysis of ATP with binding of polypeptide segments in SBD have been developed. The models were constructed through homology modeling with Hsp110 protein of *Saccharomyces cerevisiae* (open model) and Hsp70 protein of *Escherichia coli* (close model) shown as below:
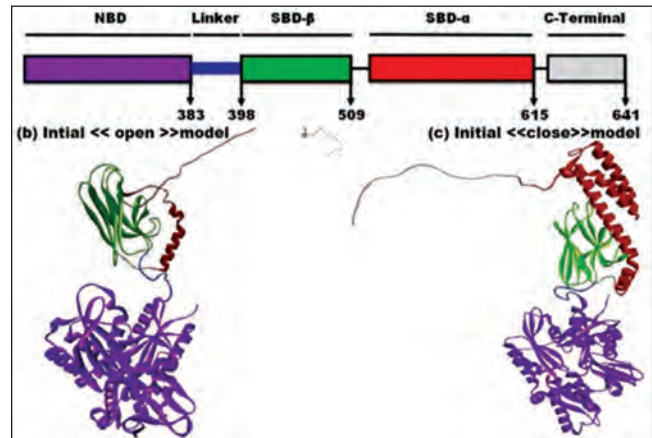


Predicted models have been validated and stable structures were obtained. The stable models were subjected to hundred nanoseconds "all-atom molecular dynamics simulations" in water solvent. The dynamics of the initial close state and transition forms of the models are investigated and analyzed. The RMSD plot of close model of camel Hsp70 (CcHsp70) shows that the backbone of protein is fluctuating up to 39.7ns with maximum 1.92 nm RMSD. After this point the NBD and SBD of structure are trying to converge to a constant value. It has been found that after 50ns the NBD, SBD and C-Terminal reached equilibrium state. The average thermal factor analysis for protein showed that only C-Terminal residues are found in intermediate and hot region (shown in green and red color respectively). Otherwise, the whole structure is laying down in cool region shown in blue color in the following figure:



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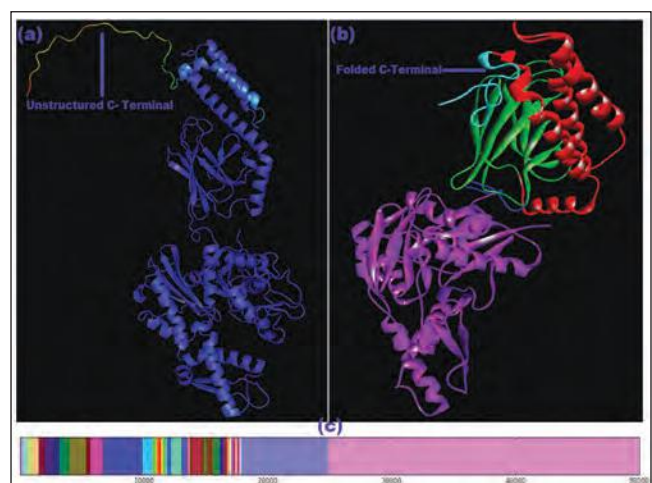
After 40 ns, the C-Terminal part was stabilized and moved between SBD-β and two helices of SBD-α. The results show that the conformational changes taken place initially in SBD, NBD and C-terminal domains later on got stabilized.

## Development of statistical approach for prediction of eukaryotic splice sites

Rice genome data was collected from Rice Genome Annotation Project and further processed to obtain true donor splice sites of length of 202 nucleotides having 100 at exon end and 102 at intron start. Further, a set of false splice sites was extracted from exonoc, intronic region by keeping the length equal to 202 nucleotides. Position wise nucleotide frequencies were calculated both for the true and false splice sites using the following formula:

From a given set of $N_s$ aligned sequences each of length $P, S_k = (x_{1k}, x_{2k}, ..., x_{Pk})$, where $x_{ik} \in \{A, T, G, C\}$; $i = 1, 2, ..., P$; $k = 1, 2, ..., N_s$, the frequency of nucleotide $b$ at $i^{th}$ position was calculated as

$$n_i^b = \sum_{k=1}^{N_s} I(x_{ik}), b \in \{A, C, G, T\} \text{ and } i = 1, 2, ..., P$$

$$\text{where } I(x_{ik}) = \begin{cases} 1, \text{ if } x_{ik} = b \\ 0, \text{ otherwise} \end{cases}$$

The frequencies were computed by considering splice site motifs of length 20bp having 10bp from the exon end and 10bp from the intron start excluding the conserved GT at the beginning of intron. The computed frequencies were used to generate bar diagram to visualize the variability in the motif. Further, Cramer's V coefficient (CVC) was computed for finding the association among nucleotides located at different positions in the splice site motifs separately for true and false splice sites. The Cramer's V coefficient was computed using the following formula:

Let $n_i^b$ and $n_j^b$ be the frequency of nucleotide base $b$ at position i and j respectively. Similarly $n_{ij}^{b \times b}$ is the frequency of pair of nucleotides $b \times b$ corresponding to the position (i, j), where $i, j = 1, 2, ..., P$ $and$ $i < j$; $b \in \{A, T, G, C\}$; $b \times b \in \{AA, AT, AG, AC, ..., CC\}$. Then a 4×4 contingency table was prepared for computing the association between any two positions with respect to the distribution of four nucleotide bases. Using this contingency table, the Pearson chi-square value was computed as

$$\chi^2 = \sum_b \sum_b \frac{\left[ n_{ij}^{b \times b} - \left( \frac{n_i^b . n_j^b}{N} \right) \right]^2}{\left( \frac{n_i^b . n_j^b}{N} \right)}$$

Then, the CVC was computed using the formula

$\phi_c = \sqrt{\dfrac{\chi^2}{N(m-1)}}$ , where $\chi^2$ is the Pearson chi-square obtained from a 4×4 contingency table and $m = \min(4, 4)$. CVCs were calculated for all possible pairs of positions, by taking 20 positions (10 positions at the exon end and 10 positions from the intron start), separately for both true and false splice sites and plotted as shown below.
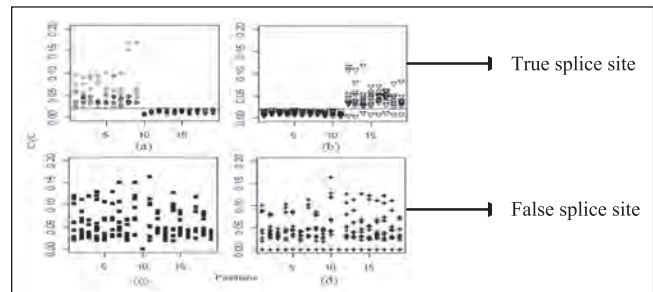


From the above graph it is observed that the associations within exonic and within intronic region are higher than that of between exon-intron and intron-exon, in case of true splice sites. But such pattern are absent in false splice sites. By taking into account the variability in position wise nucleotide frequencies and the association structure among nucleotide, the window size is determined as 9 base pair (with 3bp at exon end followed by conserved GT and 4bp at intron start). By considering this 9 base pair window size as the final window size, an association finding method is developed and heat maps were generated.

## Whole genome association analysis in complex diseases: An Indian initiative

Machine learning approaches like, Least Absolute Shrinkage and Selection Operator (LASSO), Support Vector Machine (SVM) and Random Forest (RF) were applied on the whole genome SNP data of Rheumatoid

Arthritis and Ulcerative Colitis diseases to identify SNPs associated with the diseases. The associated SNPs were located on the human genes. A total of 1299 genes were sorted for studying their functionality through GeneCards. The gene-gene interactions were further studied using GeneMania by taking into account the physical, genetical, co-localization, co-expression interactions. Finally, a total of 47 genes were found to be involved in the RA disease. A similar approach was followed in case of UC disease. The associated SNPs were further located on genes involved in Cytokine and Signal Transduction pathways.

## Modeling network of gene response to abiotic stress in rice

Transcription factors (TFs) and microRNAs (miRNAs) are primary gene regulators within the cell. Regulatory mechanisms of these two main regulators are of great interest and may provide insights into the abiotic and biotic stress. Microarray technology has enabled us to decipher the genes regulated either by miRNA or directly by TF's. There is much less information known about the mechanism that how miRNA regulated TF's target genes employ to effect co-ordinated regulation within the stress effected cell. An in-silico analysis pipeline is proposed to find transcriptional modules for regulatory gene expression signatures like miRNA and TF's. The method requires only miRNA-target information and expression profiles in the appropriate context such as tissue type or stress condition. This procedure was applied to identify key downstream targets for the 11 prognostic signature genes (TF's) for abiotic stress.
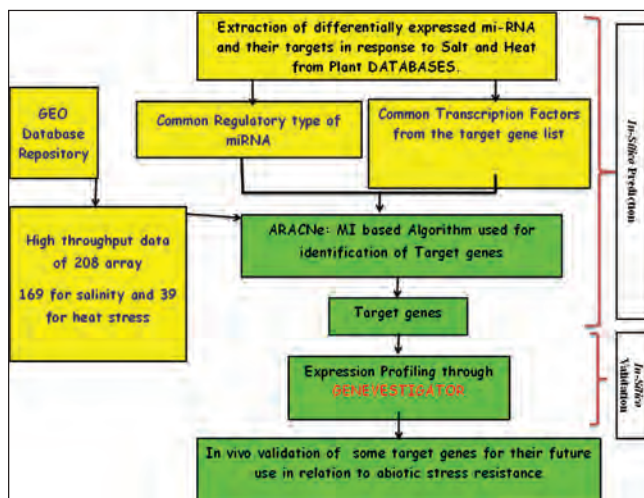


A global transcriptional network was constructed using the ARACNe algorithm that resulted in identification of 132 targets. These downstream targets include known regulators for abiotic stress inducible effects such as osmolytes accumulation, senescence and stomata development. The utility of this method may be expandable to other types of signatures such as combination of correlated biotic stress.
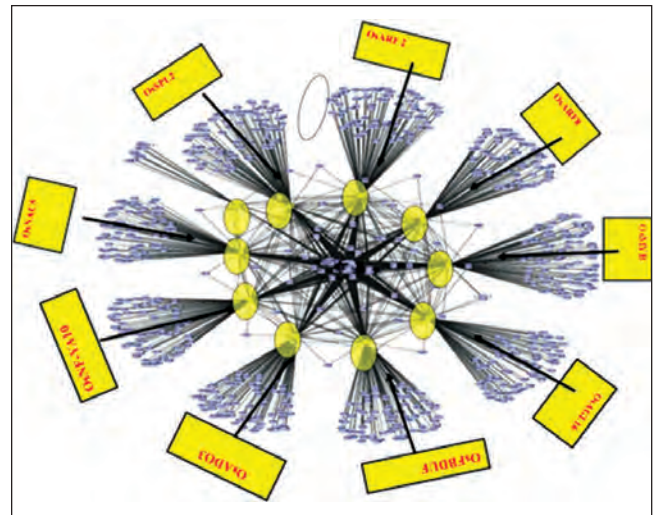


Moreover in the core binding sites that seem to be associated with transcription factor families, there may be a degree of subtlety in the *cis*-regulatory elements important for transcription factors to facilitate their unique regulatory effects in response to diverse adverse conditions. In the case study conducted, five types of cis regulatory elements were identified such as abi4, bZIP911, bZIP910, Gamyb and HMG-I/Y which may function through the recruitment of TF-target combinations with similar manner in combined stress (i.e. salt, drought and heat stress) and thus provide broad spectrum abiotic resistance. In conclusion during the coexistence of multiple stresses some combinatorial effectors work together and may provoke the major regulators such as miRNA's and TF's. These regulators in turn regulate their targets with some refined binding sites and stimulate the downstream processing. Further examination of these genes may enable the molecular basis of abiotic stress tolerance in *Oryza*, to be elucidated.

## Distributed computing framework for data mining

Protein–protein interactions are interactions between proteins that take place due to certain chemical

reactions and electrostatic forces. Predicting these interactions play an important role in reducing the time and cost of wet lab experiments. Firstly, identifying the interaction sites is needed to predict the protein–protein interactions. Using SVM, these interacting sites may be predicted. The prediction may be done using the structural information along with physico-chemical features like hydrophobicity, x-coordinates, y-coordinates, z-coordinates, surface tension, charge, alpha helix, β helix, turn, van der waals, molecular weight, solubility etc. An algorithm has been developed for prediction of protein-protein interaction using SVM. Schematic workflow of the developed algorithm is given below.
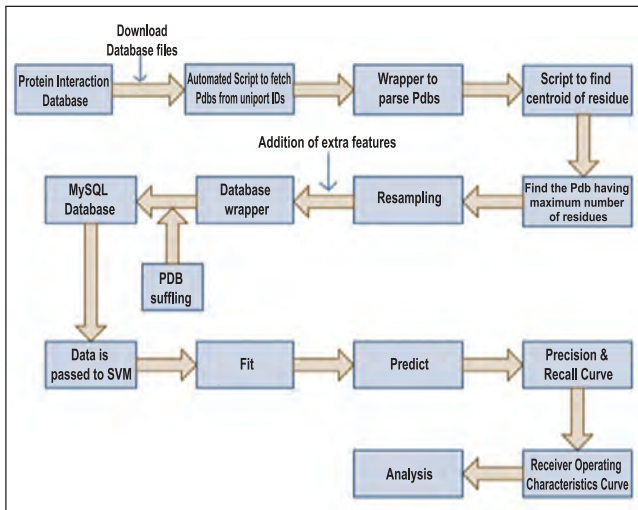


## Buffalo genome information resource

A web interface has been developed using php scripts and MySQL database to fetch orthologous annotated data of buffalo genes on cattle genome. A browser using light weight genome viewer tool has been developed for mapping buffalo genes on to cattle genome. Annotation files required for construction of genome have been prepared. Also, the information on different functional elements of buffalo genome has been parsed and populated and mapping of these elements on to buffalo genome has been done. The mapped information has been displayed through light weight genome browser tool. A website has been set up with buffalo genome database and browser tool.

## Analysis and determination of antimicrobial peptides: A machine learning approach

Antimicrobial peptide prediction models have been developed using SVM for classification of antimicrobial peptides and the same have been evaluated and compared for performance. Since SVM models performed better than ANN, these were implemented in the web server for N-terminal, C-terminal and Full sequence using CGI-PERL, HTML, PHP and available at http://cabin.iasri.res.in/amp. An additional tool for finding the protein parameters of multiple sequence has been added and available at http://cabin.iasri.res.in/protp/submission.html. A code in BIOPERL has been



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Online tool for multiple sequences with output



Web-server for prediction of cattle antimicrobial peptides

developed for furnishing protein parameters of multiple sequences overcoming the limitation of "Protparam", an ExPASy tool.

### In silico identification of abiotic stress (salinity) responsive transcription factors and their cis-regulatory elements in grape

Grape cultivation is very much affected by salinity stress due to number of reasons like unpredictable rains, poor irrigation water quality, excess use of fertilizers etc. The study was undertaken to identify salinity stress transcription factor using in silico approaches. Starting from salt stress ESTs, using a series of bioinformatics tools like EGAssembler, BLAST2GO, Phytozome, BLAST and Fgenesh, the genes were identified and sent to NRC for Grapes, Pune for validation. Also, for the identification of transcription factors, various

databases have been referred giving 7 classes of transcription factors.

### Algorithm for gene classification based on gene expression data

Problem of prediction of trait associated genes can be framed as a feature selection problem where genes of microarray data may be considered as features and the selected key genes are indicative of a trait. Many feature selection techniques are proposed to select the important genes responsible for a particular trait. Among these techniques penalized regression like LASSO, Elastic Net etc. are most popular as they deal with n<p problem. But being a linear technique, they are unable to solve the problem of non-linear input-output dependency. Non-linear Penalized SVM resolves this issue by using

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kernelized-penalized regression technique along with support vector machine. By exhausting this concept, this algorithm has been proposed for prediction of trait associated genes using non-linear penalized SVM. This Algorithm, first identifies differentially expressed genes of two classes and then applies Non-linear Penalized Support Vector Machine (SVM) to predict the key genes belonging to a particular trait and also provides a measure of prediction accuracy based on cross validation technique.

### Trait associated genes prediction tool

Prediction of trait (e.g. abiotic or biotic stress) associated genes is very useful for biological research. The microarray gene expression data can be helpful in this but it requires specialized analytical and computational support. Trait Associated Genes Prediction Tool (TAGPT) is a user friendly web based analytical solution developed for the same. TAGPT implements the proposed algorithm based on sound statistical principles and requires microarray gene expressions data as input. This tool provides login facility to the users. Three types of input parameters are required to run this software- a) a file containing microarray gene expression data in .csv format with genes as rows and samples in columns, first column name of the genes must be GeneID, b) file of response variable in .csv format and c) level of significance e.g. 0.05 on the basis of which differentially expressed genes are identified. Genes predicted by this tool may provide useful postulate for wet-lab experimentalists to verify.

### Parallelized workflows for gene prediction, phylogenetic analysis and primer designing

A bioinformatics workflow system is a specialized form of workflow designed specifically to compose and execute a series of computational or data manipulation steps, or a workflow, in a specific domain. Designed, developed and build local genome database required for workflows, developed a parallelized pipeline for identification of gene from Expressed Sequence Tags (ESTs), developed a workflow system for phylogenetic analysis on parallel architecture and developed a pipeline for identification of SSR Markers and primer designing using parallel computing tools and libraries. The software for online phylogenetic analysis has been developed. The bioinformatics tools integrated in this workflow are BLAST, CLUSTAL-W and PHYLIP. The software development for online SSR Marker-Primer Design has also been completed. In this workflow, MISA program has been integrated. MISA output is stored and parsed for display on the web form. For development of workflow for gene prediction, BLAST2GO has been studied and various available options were looked into especially for blast, mapping, annotation, interproscan and pathway using some example input sequences. A database has been designed and developed for storing the EST, contigs, their properties and relationship among them. Script is being developed for populating the database from excel file.
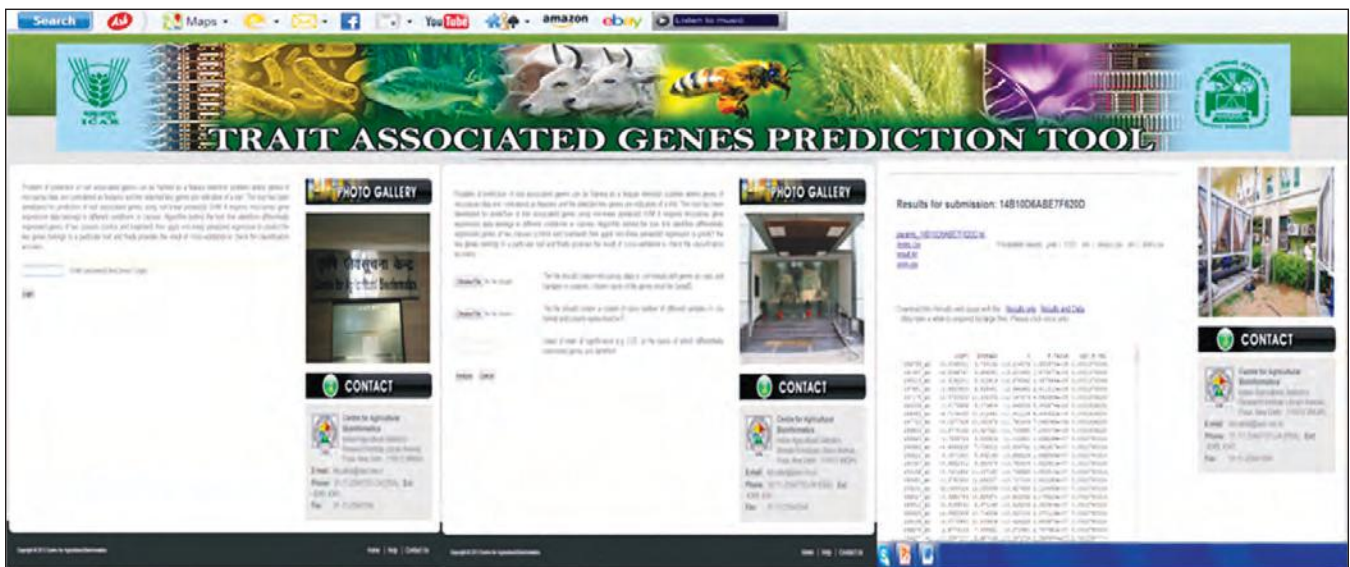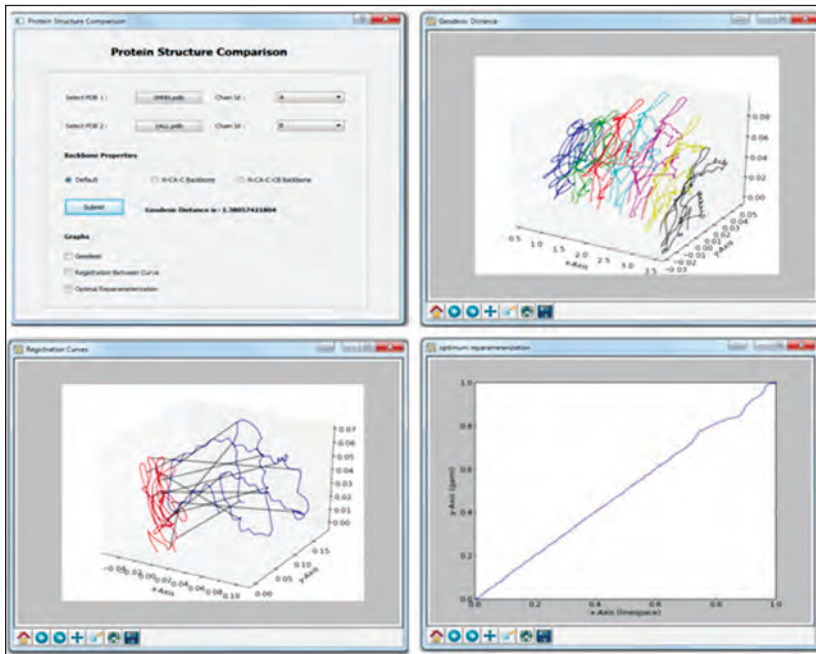
## Methodology for protein structure comparison and its web implementation

A GUI has been developed for protein structure comparison using elastic shape analysis that is based on a recent work done in which the sequence of 3D coordinates of backbone atoms (N, Cα and C) are used to derive the curve from the protein structures. Besides using only the backbone atoms, a better way of deriving curves from protein structures are used for comparison. In the GUI for protein structure comparison, the representations of protein are based on the three criteria, *i.e.*, by using (i) the backbone atoms (N, Cα and C) only, (ii) the centroid of backbone atoms for each residue and (iii) the centroid of backbone atoms including Cβ atoms for each residue. It will be helpful in addition of the extra information to the shape coordinates, development of a suitable score for comparing protein structures, *etc*. It calculates the geodesic distance and also gives the graphical display of geodesic path between the curves, registration between the curves and optimal reparameterization.

## Programme 5: DEVELOPMENT OF INFORMATICS IN AGRICULTURAL RESEARCH

### Strengthening statistical computing for NARS

Statistical computing methods enable to answer quantitative biological questions from research data so that the amount of information generated is maximized. In order to provide statistical computing environment in NARS, the imitative on Strengthening Statistical Computing for NARS (SSCNARS) funded by NAIP of ICAR was undertaken. Implementation of this consortium in 3-tier structure with first tier as lead centre, 08 NARS organizations as Statistical Computing Hubs and 142 other NARS organizations as nodes is unique effort in the sense that each NARS organization is linked with each other, which has resulted into effective collaboration among all NARS organizations. This has empowered the statisticians and other researchers by creating healthy statistical computing environments and by providing the high-end statistical computing package(s) for statistical computing as is available at premier Institutes. It has provided the statisticians an opportunity to interact with each and every researcher of NARS through training programmes and e-resources. The achievements, usage and impact of this work is summarized in the sequel.
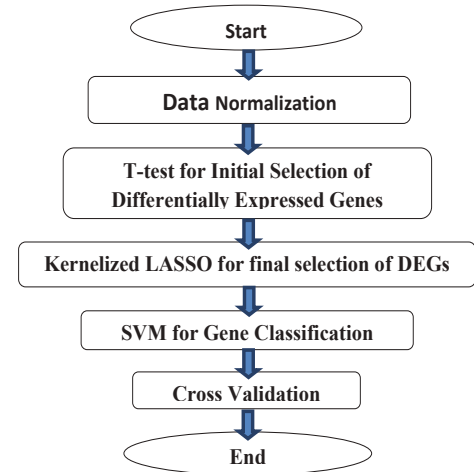
- **Capacity building**

  283 researchers have been trained on Data Analysis using SAS through 13 training programmes of one week duration each. With this the number of researchers trained has gone upto 2166 through a total of 104 training programmes.

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Out of these 13 training programmes in 2013-14, 02 were organized by IASRI, New Delhi and rest 11 by consortium partners. Nine of these 13 training programmes were organized at doorsteps of the users such as IISS, Bhopal; SKUAST, Jammu; CSWCRTI, Dehradun; CRIJAF, Barrackpore; CAU, Imphal; PDADMAS, Bengaluru; CIFT, Kochi, TANUVAS, Chennai and TNAU Coimbatore and one was subject specific on Predictive Models in Agricultural and Aquaculture Research. 18 RA/ SRFs of NAIP- PIU and SRFs at IASRI, New Delhi were also trained through a training programme during June 28-29, 2013. The distribution of the participants trained in different years and by different statistical computing hubs is given in the figure below.
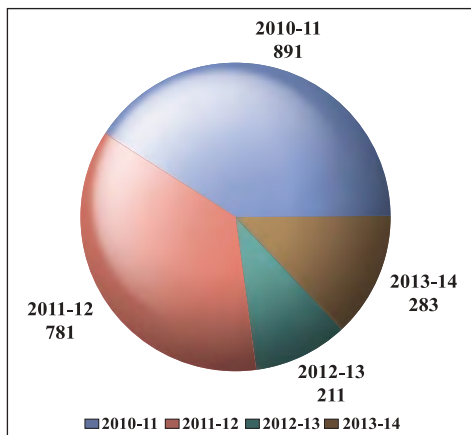


Year wise distribution
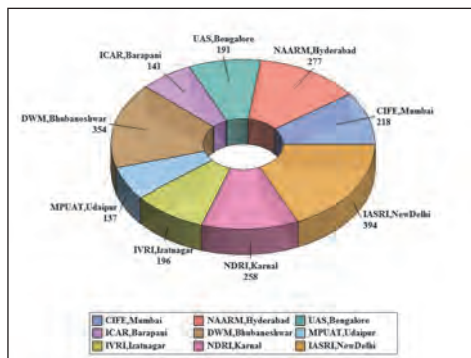


Statistical Computing Hub wise distribution

● **Updates, upgrades and installation**

Updates and upgrades were received. To sort out implementation issues and refinement in installation process, handing over of updates and upgrades and to have a face to face interaction with nodal officers, fourth Workshop-cum-installation training programmes were organized at 09 Statistical Computing Hubs. During these meetings presentations were made on Indian NARS Statistical Computing Portal. Nodal Officers were requested to conduct a half day seminar at their respective organizations and provide link of the website of the project on websites of their respective organizations. License files for the year 2013-14 were sent to all Nodal Officers through E-mail and also uploaded on Resource Page of Indian NARS Statistical Computing Portal at http:// stat.iasri.res.in/sscnarsportal/public. The software has been installed on more than 2750 computers in all 151 NARS organizations (average more than 18 machines). The publications prepared (i) Quick Reference Guide: Installation, Maintenance and Trouble Shooting; (ii) Poster on Indian NARS Statistical Computing Portal and (iii) Installation Manual for SAS 9.3. were released on September 17, 2013 by the dignitaries during the Partner's Meet.



● **Strengthened Indian NARS statistical computing portal**

Strengthened Indian NARS Statistical Computing Portal for providing the service oriented computing through IP Authentication by adding 6 more modules on sub descriptive statistics; split factorial (main AxB, CxD) designs; crossover designs; principal component analysis; estimation of heritability along with its standard error from half sib data and estimation of genetic variance_covariance from data generated from block designs. The service oriented computing modules available on

Indian NARS Statistical Computing Portal were reorganized into four broad categories viz. Basic Statistics, Design of Experiments, Multivariate Analysis and Statistical Genetics. The module on Correlation was modified by incorporating the options of classification and with variables and the module on regression analysis was strengthened by making the provision of performing regression analysis group wise. The other important features of the portal are as follows:

(i) Customized output;

(ii) Important findings are easily understandable by the researchers;

(iii) In most of the analyses, appropriate tables are created which can be used directly in Reports/Publication
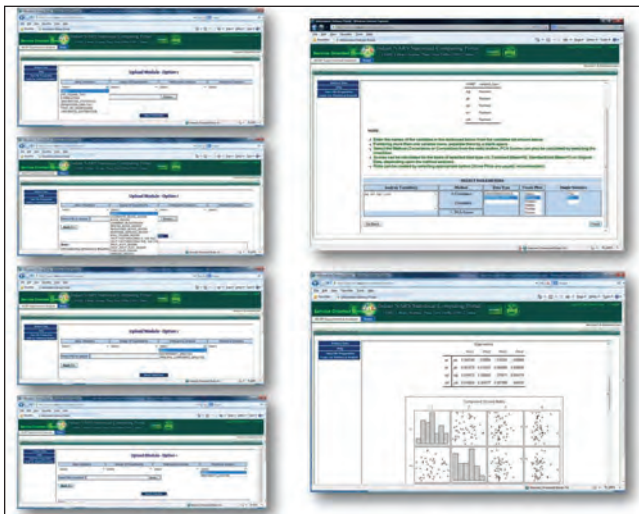


The portal is extensively being used throughout NARS and has helped the researchers in analyzing their data in an effective manner.

- **Prototype for AICRP**

For creation of research data repository and standardization of analysis of data for All-India Coordinated Sorghum Crop Improvement Project, a prototype has been developed by NAARM, Hyderabad and IASRI, New Delhi in collaboration with Directorate of Sorghum Research Hyderabad. This system was made operational and now made available at www.aicsip.naarm.org.in. The prototype for automation of All India Coordinated Sorghum Improvement Project needs to be scaled up to cover all AICRPs through a separate mega network project for paving the way for developing research data repositories, standardizing the analytical modules and saving on time and resources.

- **Macros for customized analysis and e-reference manuals**

For customized analysis, developed following 2 macros:

➢ Split Factorial (main A x B, sub C x D) designs at http://www.iasri.res.in/sscnars/spltfactm2s2.aspx.

➢ Estimation of heritability along with its standard error from half sib data at http://www.iasri.res.in/sscnars/heritability.aspx

e-Reference manual on Dairy Sciences Research Using SAS consisting of 8 lectures was prepared and uploaded on http://www.iasri.res.in/sscnars/content_dairy.htm.

➢ A case study on Fitting of Multi-phasic Logistic Function for Lactation Curve was added in http://www.iasri.res.in/sscnars/cs_animal.htm.

➢ Two new lecture notes (i) G x E Interaction Using JMP Genomics and (ii) Non-parametric tests Using SAS were added to the manual on Data Analysis Using SAS.

- **Sensitization of researchers**

Website of the project is being maintained and updated regularly. The website contains information about the sub-project, project team, nodal officers. Prominent links on the website are the 8 Reference Manuals and Case Studies, 7 Macros for customized analysis, Important Links (specially link on Webcasts and Webinars), FAQs,

Feedback and IP Authenticated Services. The website was registered under google analytics on November 15, 2010. Till March 31, 2014, there were 43,239 page views across 529 cities of 82 countries. Average time on page is 3.03 minutes.

➢ E-mails regarding availability of high-end statistical computing environment and Indian NARS Statistical Computing Portal have been sent to more than 3500 researchers.

➢ Website link has been provided at ICAR Website under important resources.

➢ For efficient and effective use of Internet Technologies for delivering lectures to save funds and resources, several Webinar sessions were organized in collaboration with CRIDA, Hyderabad where the licenses for Webinar sessions have been procured. Webinar sessions were also organized through the use of Social Networking Tools (Google Hangouts).

➢ To sensitize the scientists in NARS with the statistical computing capabilities available for enhancing their computing and research analytics skills, organized 21 sensitization workshops at different NARS organizations.

➢ To sensitize the researchers about the availability of this high end statistical package, 203 participants were sensitized through 08 sensitization training programme-cum-workshop organized at NCIPM, New Delhi; Project Directorate on Cattle, Meerut; Indian Institute of Vegetable Research, Varanasi; NDRI, Karnal; DWR, Karnal; Dr. YSP University of Horticulture and Forestry, Nauni; MOUAT, Udaipur and CIFE, Mumbai. 60 researchers were sensitized by following Nodal Centres: (i) NCAP, New Delhi organized a 2 days training programme on Price Forecasting Using SAS Software to train the researchers working on Market Intelligence Network Project and (ii) Centre for Environment Science and Climate Resilient Agriculture, IARI, New Delhi on Concepts on Statistical Computing.

➢ Nodal Officer from CRRI, Cuttack conducted a training programme on Statistical Analysis using SAS Software for 28 scientists from CRRI and SMS of KVK under CRRI.

➢ It has been included in the FOCARS training programmes conducted by NAARM, Hyderabad and 799 scientists (571 reported earlier) have been sensitized about the capabilities of the software and data analysis using SAS. Also, 211 scientists were sensitized through Refresher Courses conducted at NAARM, Hyderabad about data analysis using SAS

➢ Presentations were made in 18 training programmes/ Workshops/ Conferences/ Special Sessions at different NARS organizations

● **Usage and impact in NARS**

The capacity building efforts have paved the way for publishing research papers in the high impact factor journals. Researchers have started making effective use of the software.

➢ Based on partial feedback received from NARS organizations, 173 research reports (105 reported earlier) and 260 research papers (201 reported earlier) have been published/ accepted for publication by analysing the data using high end statistical computing facility (out of these 260 research papers, 135 are in Journals with NAAS rating > 6.0); more than 300 students (143 reported earlier) have used this in their dissertations; 1700 students (1229 reported earlier) have used in their course work. 6000 data sets (3420 reported earlier) have been analyzed using SAS. More than 100 NARS organizations have analyzed more than 5 data sets.

➢ The users have opined that the interventions have been helpful in drawing statistically valid conclusions, use of complex statistical techniques and save on time and resources. Some specific comments/feedback from research managers and users are given at the link "Reviews and Comments" on the Consortium Website www.iasri.res.in/sscnars.

➢ Number of hits at Indian NARS Statistical Computing Portal: 1,97,816 since April 01, 2011 which amounts to more than 100 hits per day. Based on the user logged information, the total number of logged in users from Indian NARS since March 2012 are 24,926. The month wise distribution of logged in users is depicted below.
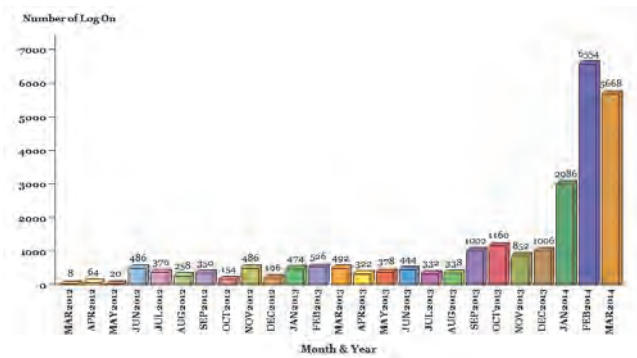
➢ The high end Statistical Computing Package procured with perpetual license can be used till hardware and operating systems would support the versions available as on June 29, 2013. Hence, the statistical computing environment created would be useful in all future research endeavours. The capacity building efforts made are expected to have a multiplier effect.

**Project Information and Management System of ICAR (PIMS-ICAR)**

Project Information and Management System of ICAR (PIMS-ICAR) is being maintained at the central server of IASRI, New Delhi and is accessible at http://pimsicar. iasri.res.in/. PIMS-ICAR has also been linked with Half Yearly Progress Monitoring of Scientists (HYPM) system. HYPM is an ongoing activity of ICAR and projects related information considered in this system from the PIMS-ICAR. Data from PIMS-ICAR has been migrated to newly developed ICAR-ERP system. At present, 5990 ongoing and 6180 completed projects are available in the PIMS-ICAR. The RPP-III of 4323 projects has been uploaded by institutes and available in PIMS-ICAR.

**National Information System on Agricultural Education Network (NISAGENET)**

National Information System on Agricultural Education Network (NISAGENET) in India has been designed, developed and is being maintained at the servers of IASRI. It is accessible from the IASRI web site as well as from the link http://nisagenet.iasri.res.in to provide country/state/university/college level reporting on agricultural education in India. The NISAGENET acts as a single Window Information Delivery System. At present with the support and supervision of the Education Division of ICAR, this project is being

executed by the Division of Computer Applications, IASRI. Following three workshops have been organized during the period for data validation and improving the quality of data:

1. Two days National Workshop on NISAGENET at OU&AT, Bhuvneshwar, Odisha during Nov. 11-12 2013.16 Nodal officers attended the workshop and deliberated on issues regarding the data quality and quantity. It was decided that the interventions will be made in the existing university processes that generate these data. A copy of the notifications will be marked to NIASGENET cell of the university.

2. Two days National Workshop on NISAGENET for Appraisal cum Validation of Data was at University of Agricultural Sciences, Bangalore during 09-10 January 2014. The Nodal Officers and Associates were involved in data management activities from different SAUs mostly from southern zone participated in the workshop. Dr. K. Narayana Gowda, Vice Chancellor, UAS, Bengaluru inaugurated the workshop and also released a compendium on Revised Data Collection Schedules for NISAGENET.

3. Two days Appraisal Workshop on NISAGENET for Constituent/Affiliated Colleges of MPKV Rahuri during 19th -20th March 2014. Forty constituent/ affiliated colleges participated in the workshop.

A new Validation module has been conceived to improve the data quality of the system and 3 sub modules of validation module are completed, other sub-modules are in progress. A functionality has been developed 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 facility is in the testing phase. Data quality is substantially improved for number of faculty, students admitted and passed out for the year 2012-13. Data has been collected from all university web sites about their constituent and affiliated colleges and the same has been updated in the database. Regular contact and technical support has been maintained with the Nodal Officers of each university for data uploading and validation in NISAGENET.

**Half-Yearly Progress Monitoring (HYPM) system**

For building centralized monitoring environment, facilitating coordination and fostering partnerships

between and within all ICAR institutes, the need was felt at the council to establish a platform that provides a hub for sharing research and developmental activities being undertaken by the scientists in ICAR institutes. To frame the necessary guidelines for establishment of such system, a committee was constituted by the council under the chairmanship of Dr. P.L. Gautam. On the basis of the committee's recommendations, a portal for Half Yearly Progress Monitoring (HYPM) was developed at IASRI, New Delhi and implemented in all ICAR institutes in the country.

HYPM has been designed and developed in 3-tier web architecture on the .NET platform. The system has a user interface for on-line data entry, updation, and modification of self monitoring in terms of targets and achievements at individual scientists level. The functionality to report and review by the respective reporting and reviewing officers at institute level is an integral part of the system. An interface for reports and queries to meet the requirements of ICAR along with a graphical user interface (GUI) for reviewing the progress at SMDs and DG level has also been made available. For implementation of HYPM, the major activities undertaken by IASRI are as follows:

➢ Zonal Sensitization and Training workshops were organized in 4 zones of the country.

➢ Made Liaison with all Nodal Officer and/or I/C of PME Cells of ICAR institutions for customization and maintainance of HYPM from their respective institutes.

➢ The Nodal Officers were trained to customize and generate UserId and Passwords of the Scientists, Reporting / Reviewing Officers of their respective institutes.

➢ For any refinement, modifications and/or updates of HYPM software as per future requirements, all technical support was provided.

The following documents have been published under the project during the period:

1. Reference Guide for Data Management in HYPM
2. Reference Guide for Scientist in HYPM
3. Reference Guide for Reporting Officers in HYPM
4. Reference Guide for Reviewing Officers in HYPM







**Exploration of central data warehouse for knowledge discovery**

This work was an initiative to create a pipeline structure for the process of knowledge discovery using SAS E-Miner. The Central Data Warehouse (CDW) designed and developed at IASRI as agricultural data repository was studied. 61st Round NSSO data (MPCE) was selected to develop a prototype for knowledge discovery. The data was extracted from CDW and was stored on CDs in MS EXCEL format. The prototype was developed in SAS environment. The following

were studied and used to develop the prototype: Base SAS, SAS Enterprise Guide, SAS Enterprise Miner, SAS OLAP Studio, SAS Management Console, SAS Information Map Studio, SAS Information Delivery Portal, SAS Web Reporting Studio.



MPCE Year Range across Geography- Bar Chart representing the Cube



Web Report through table and graph (drilled down)



Saving the report

This end-to-end process of creating an OLAP Cube to publishing on the web was done for the data of Bihar State. The cube was published on the Indian NARS Statistical Computing Portal, IASRI, New Delhi. The screen shot is given below.



Bihar State OLAP Cube published on web
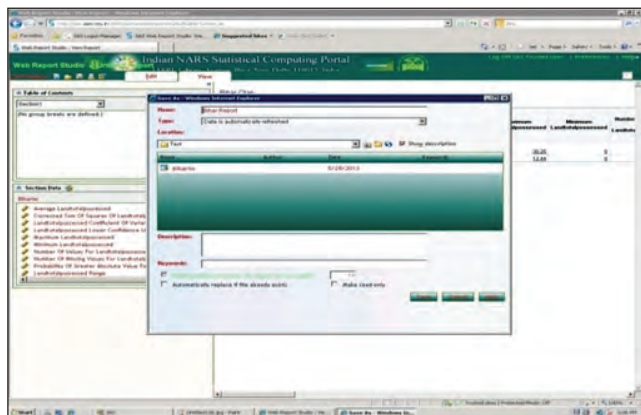
The prototype was also developed for knowledge discovery or data mining of the MPCE data from 61st round NSSO data. For discovering knowledge from the data, two data mining tasks were selected namely, Classification and Association Rule Mining. Data mining requires the data to be pre-processed as per the need of the task and technique to be used. In this prototype development, for classification of data, Decision Tree technique was for Association Rule Mining, the algorithm selected was A-*priori*.

For knowledge discovery, data from three districts of Haryana state was used. For Classification, three districts namely, Faridabad, Sonipat and Rohtak were selected and decision tree was used for classifying the data. For Association rule mining, one district, Faridabad was selected. Haryana state data was first extracted from the NSSO dataset. Once the state data was available, the data from the selected districts were extracted. There were two tables which were then merged to include the variables to be classified. Variables which were not to be used for classification were removed and the data was cleaned. MPCE data was used for classification and the final dataset that was classified contained the following variables: MPCE Year, Total Land Possessed, Household Size, Religion and Social Group. The target variable was MPCE Year. It was classified based on the rest of the independent variables.

Classification Accuarcy

| District | Attributes Used for classification | Classification accuracy |
|---|---|---|
| Sonipat | Religion, Social Group, Household Size, Land Total Possessed | **100%** |
| Faridabad | Religion, Social Group, Household Size, Land Total Possessed | **96.0%** |
| Rohtak | Religion, Social Group, Household Size, Land Total Possessed | **96.0%** |
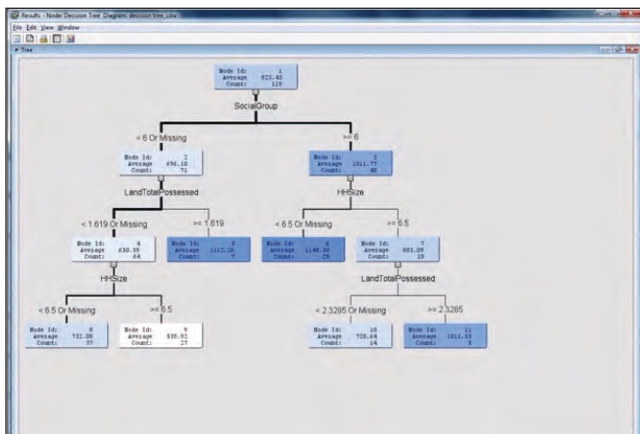


Decision Tree

Association rule mining is carried out on transactional data. The data from NSSO (MPCE) was not in a transaction data format. Therefore, the data of Faridabad district was pre-processed and it was brought to the format of being a transactional dataset.



Association Rule Mining Results

For the analysis, the following variables were selected: MPCE Year, Total Land Possessed, Household Size, Religion, Social Group and Sector.

An interface has also been created to accumulate all the resources developed. The interface contains the prototype of OLAP cube creation, its web report and web publishing. It also contains the various resource materials related to multidimensional OLAP cubes, data mining such as research papers, lecture notes and e-books. .NET Technology and Language C# has been used to develop the interface and the database used is Microsoft SQL Server 2008. The following resources have been developed:

➢ One Technical Report entitled "Status Report on the Data Available in the Central Data Warehouse" has been prepared.

➢ User Manual for "Developing multidimensional OLAP cubes, Web Publishing of OLAP Cubes and Generating Web Reports in SAS Environment".

➢ User Manual for "Knowledge Discovery using SAS Enterprise Miner."

➢ A prototype for "Developing multidimensional OLAP cubes, Web Publishing of OLAP Cubes and Generating Web Reports in SAS Environment".

➢ A prototype for "Knowledge Discovery using SAS Enterprise Miner".

➢ An interface to accumulate all the resources developed in the project.

**Management system for post graduate education-II**

This system aims to strengthen the software developed in the project "Management System for Post Graduate Education" for management of day to day activities.

➢ Created functionalities to change major discipline; major fields for all the disciplines; capture major field for passed out students at guide level; add 2 credits and related marks of Qualifying Examination and Thesis Examination in student's PPW and the corresponding grades at professor's level; defining the Co-Chairman at student, Faculty and Guide levels; pending job notification for PG School officials; to allow repeat course by student at admin level.

➢ Created a report to view the status of course schedule entered by the faculty in e-learning module. The report shows the faculty and course

name for which the course schedule is pending or filled. The report is visible at Dean and Professor level. Created 26 reports for automating the personal file of M.Sc. and Ph.D. students by the PG-School Officials. In PPW and ORW reports, Print Status facility has been created at PG School Official level for filing purpose.

➢ Reconfigure report of result pending at admin level, user registration form at faculty level, assign grades in guide and professor alert table, the result upload through CSV file, thesis and qualifying date form at admin level, radioactivity form at student level.

➢ Modifications were made in PPW at all levels as per PG School feedback, AAO and AIM level. In ORW, reason for changing Thesis Title is made mandatory for students, if the student changes his/her Thesis Title. Provision has been made to attach the scanned copy of the transcript and PDC/Degree of the last attended degree in the qualification form. Filling of academic background field has been made mandatory and the same has been shown in PPW for taking remedial courses to non-agriculture background students. Provision has been made to fill up OGPA or % with Maximum OGPA and percentage in the qualification Performa. Indian format of date changes were made at AAO, AIM and PG School Officials level. Modified student's degree functionality according to PGS Administration and sample degree in Bilingual format (Hindi and English) has been published. Modified student's transcript functionality as per the need of PGS Administration.

➢ Started activities related to implementation of MS-PGE system in other deemed universities on their request.



➢ The system has been set up for CIFE Mumbai, NDRI Karnal and IVRI Izatnagar with blank database. These will be configured according to the specific configuration and courses of these universities.

➢ Solved queries related to result upload for II, III trimester 2012-13 and course registration for III trimester 2012-13 and I trimester 2013-14. Provided support to all the students and faculty for the smooth functioning of the system. Regular back up and system maintenance were performed.

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

This NAIP funded project was started at IASRI from January 2012 with the objectives to implement the robust and flexible MIS & FMS at ICAR and to establish ICT Infrastructure and Unified messaging & Web hosting solution for ICAR. For this, an ICAR-ERP solution has been developed based on customization of ORACLE ERP software and the solution has the following components:

(a) Financial Management: General ledger, Accounts Payable, Accounts Receivable, Cash Management, Fixed Assets Management, Budget Management and Grants.

(b) Project Management: Project Information, Costing, Project Documents, Contract Management and Collaboration of Project documents.

(c) Material Management: Purchase and Inventory Management.

(d) Human Resource: Employee information, HR policies, Leave Management, Performance and Appraisal System.

(e) Payroll System: Salary, GPF, Pension Payment, Retirement Benefit Calculation and Income tax calculation solutions for ICAR employees.
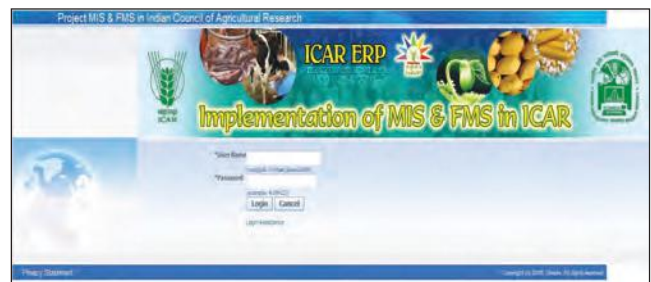


Home Page of ICAR-ERP

ICAR-ERP system is hosted on IASRI website and can be accessed through www.icarerp.res.in. ICAR-ERP system has been developed under the guidance of core team identified in each of these areas and tested in the user acceptance testing workshops organized at IASRI from 08-28 May 2013. Sensitization workshops and trainings activities were carried out in collaboration with partner organizations at their respective locations as well as at lead centre IASRI. More than 500 Personnel from different sections of NBPGR, New Delhi; IARI, New Delhi; CSSRI Karnal, NBAGR Karnal, IASRI, DWR Karnal, DMR Solan, CPRI, Shimla, IVRI Bareilly, ICARER Patna and CRIJAFT Calcutta were sensitized for MIS/FMS implementation along with detailed discussion on data digitization templates during Sensitization workshops.

ICAR-ERP has been implemented in IASRI, IARI, NAARM, CIFE NDRI from 1st February 2014 and ICAR HQ and IVRI from 26th February 2014. The System has been implemented in CPRI, CRRI, NBSS&LUP, CAZRI, CIAE, CSWCRTI, IGFRI, CRIDA, IIHR, CMFRI and NBPGR from April 2014.

A number of training programs were organized at IASRI and Partner organization for imparting training to institute personnel on different modules of ICAR-ERP solution. Personnel from NDRI, IARI, NAARM, CRIDA, CIFE, CIRCOT, IVRI and Delhi based institutes NCAP, NBPGR, IASRI, DMR, DFR, NCIPM, NRCPB were given training on the ICAR-ERP solution. Eleven (11) user manuals were prepared along with Computer Based Training Material (CBT- 102). This material is available on the project website http://www.iasri.res.in/misfms/.

institutes (CMFRI, CRIJAF) participated in these workshops. Approximately 220 personnel participated in these workshops.

| Module Name | Duration | | No. of People Attended |
|---|---|---|---|
| | **From** | **To** | |
| Project Module | 08-May-2013 | 10-May-2013 | 37 |
| Purchase & Store Module | 13-May-2013 | 15-May-2013 | 26 |
| Finance Module | 15-May-2013 | 18-May-2013 | 57 |
| HR & Self Service HR Module | 20-May-2013 | 22-May-2013 | 43 |
| Payroll and Pension Module | 23-May-2013 | 25-May-2013 | 31 |
| Grants and Budgeting Module | 27-May-2013 | 28-May-2013 | 25 |

| Sr. No. | Module Wise | No. of Batches (No. of Days) | No. of Personnel Trained | Organizing Institute |
|---|---|---|---|---|
| 1 | HRMS and Self Service HR | 8 (2) | 148 | IARI (16 Sept. - 12 November 2014), |
| 2 | Payroll and Pension | 6(2) | 152 | NDRI (29 August- 19 September), |
| 3 | Financials | 6(4) | 176 | NAARM (11 -30 Nov.) |
| 4 | Purchase and Stores | 6(2) | 153 | CIFE(29 Nov- 12 Dec), |
| 5 | Project MIS | 33(2) | 943 | IASRI (7 Nov- 12 Dec) |



**User Acceptance Testing (UAT)** workshops were organized in IASRI, New Delhi. Phase-I (A) institutes (ICAR HQ, IARI, NDRI, and NAARM) along with partner



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## Establishment of IT infrastructure, uniform messaging and web hosting facility

Another important work in the institute is uniform mail messaging and web hosting services for entire ICAR organizations. This facility is needed for creation of email id with ICAR domain for all the ICAR personnel and unified messaging solution. This facility has component of hosting the websites/ web applications developed at different institutes of ICAR. Bid document as per International Competitive Bidding (ICB) format was prepared and after approval of World Bank bids were invited for this component. Bid evaluation was carried out and with the approval of World Bank notification of award was issued. This facility is expected to be operational by June 2014.

## Phenomics of moisture deficit and low temperature stress tolerance in rice

The major challenges to crop productivity are the abiotic stresses such as drought, cold and heat. The characterization of stress tolerance phenome will guide designing newer tools and techniques for precise genetic manipulation of crops to meet the challenges of stress under changing climate. In a long-term perspective, the knowledge and experience gained in the proposed phonemics research programme will act as a primer for initiating more such programmes by extending the experience gained to other crops and many other stress situations. The understanding in rice will give confidence in handling more elaborate phenomics research. Helped the Lead centre (IARI) in developing and finalizing the specification of computing infrastructure at central phenomics facility. An online multimedia data management system for



Process of image capturing of rice plant

capturing the data generated has been developed. The system was launched in the project workshop on 1st June 2013. Training has been given for entering data in the data capturing system to IARI project staff. The system has been developed using IDE NETBEANS IDE 7.0., Server: Apache Tomcat 7.0., Language Used: JSP, XML, HTML. 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 image data for stress and control condition for multiple genotypes of rice was collected. The data regarding the chlorophyll and carotenoid content was also collected. Based on the recorded observations, an approach has been developed to estimate the carotenoid content in the plants through image analysis and ANN. An online module has been developed for the same and integrated with the multimedia data capturing system. Initially ANN was used in MATLAB software and the same is being tried through R, JAVA, so that online analysis can be done. Another approach was developed for estimating the leaf area of rice plant through image analysis. The approach is translated into an online module for leaf area calculation and integrated with the online multimedia data management system.



Online system for Leaf Area Estimation

## Strengthening and refining of maize AgriDaksh

MaizeAGRIdaksh system provides the information and solution of various problems faced by the farmers such as identification of a pest or a disease or variety selection for a particular purpose and location. It

has also established a Maize Expert Network for Answering Farmer's Questions through E-Mail. During the reporting period the Maize AGRIdaksh was made multilingual and information is provided to the farmers in Hindi and other Indian Languages. Package of practices for the cultivation of corn, Baby Corn, Sweet Corn farming have been uploaded for various states. A large numbers of farmer's questions were replied by the Maize Experts through the system. The system has been modified for correcting errors related to data entry in other languages such as Tamil, Telugu, Punjabi and Bangla. Information on various varieties has been uploaded in Hindi, Punjabi, Tamil and Telgu. Information on 10 weeds has also been added in Hindi and Tamil. The system has functionality to capture various terms in multiple languages and it uses them across the system at appropriate places. Using this functionality various terms of Tamil, Telugu, Punjabi and Bangla languages have been added. Regular support has been provided to DMR for data updating as well as maintenance and



Information provided at website in Hindi



The webpage showing varieties for Andhra Pradesh

hosting of the AGRIdaksh system was carried out. The system has been accessed 4827 times (17 March 2012 to till date) and 1695 times during the last six months from 61 countries and from all states of India.

**Development of web based mushroom expert system**

Expert system for mushroom crop has been developed using AgriDaksh tool. This system is a farmer oriented and user friendly software which provides spectrum of information with images of mushroom crop such as cultivation technology of different mushrooms, diseases and pest management, spawn production technology, compost preparation by short and long method, Post harvest handling and harvesting, Crop management, Nutrition and medicinal value, Transfer of technology, fungal, viral, bacterial diseases and abiotic disorders etc. Cultivation Technology module gives detail information about compost preparation, spawning, spawns running, casing, fruiting. Post harvest management module gives detail information about Packing and Storage and Short Term Storage. Pest and Diseases module gives detail information about Insects, Pest like Nematodes, mites and springtails and several diseases like Dry Bubble (brown spot), Wet Bubble (White Mould), Cobweb, Green Mould, False truffle (Truffle disease) etc, and timely control measures against pests and diseases. The system was launched and demonstrated in Mushroom Mela on 10th September 2013 by Prof. V.S. Thakur Honourable Vice- Chancellor of Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Solan. The system is accessible from IASRI and DMR, Solan website and also from http://agridaksh.iasri.res. in/mushroom.jsp



Disease diagnosis in mushroom

## Strengthening of digital library and information management under NARS (e-GRANTH)

Strengthening of digital library and information management under NARS (e-GRANTH) is a subproject of component-1 of NAIP. National Agricultural Research Education System (NARES) in India comprises of Agricultural Research Institutions and Agricultural Universities. The Library at IASRI is one of the library partner of this e-Granth project and has a good collection of Books, Bound Journals, Theses, Dissertations, Reports, Reference Books, Electronic Resources, Compact Discs and DVDs on Agricultural Statistics, Computer Application and Bioinformatics and many more. Under this project, Debian Linux operating system and Koha (LMS) have been successfully installed and implemented in the IASRI library. Now IASRI Library will be library partner of AgriCat. It is a Union Catalogue of the holdings of 38 libraries of the ICAR Institutes and SAUs combined together. Union Catalogues are useful to librarians, scientists, students, researchers. With the help of union catalogue, librarian can assist in locating and requesting materials from other libraries through interlibrary loan service. Online Computer Library Center (OCLC), USA will enable libraries to be discoverable by the network of global library system and sharing of online resources more effectively.



## Engaging farmers, enriching knowledge: Agropedia II

Agropedia is an online knowledge repository and knowledge management platform for information related to agriculture. It hosts wide range of agricultural information on a variety of crops in a variety of ways. The Agropedia portal is currently available at http://www.agropedia.in. This complete system has been explored for its proposed migration from IIT, Kanpur to IASRI, Data Centre New Delhi. The software and hardware requirements for migrating the system were identified and the functionalities of the Agropedia system were explored and documented. A workshop for capacity building of new partner institutes was organized at IASRI in collaboration with ICRISAT on 15th July 2013. Visit has been made to IIT Kanpur to have better understanding of Agropedia system and have knowledge sessions with Team Agropedia, IIT Kanpur. The backup of the portal (http://agropedia.in) given by IIT Kanpur, in August 2013 has been restored on Debian7 Linux platform on a local server machine at IASRI, New Delhi. A two days training programme on technical aspects of configuring the local server as per Agropedia requirement was organized at IASRI. The new Agropedia site for IASRI has been prepared and is made functional at http://iasri.agropedia.in.
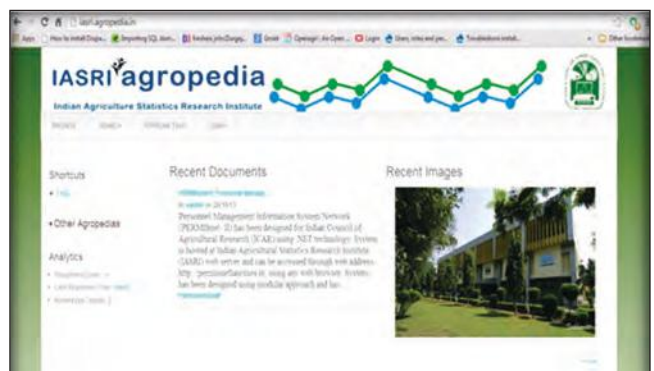


Homepage of IASRI Agropedia available at http//iasri.agropedia.in

A knowledge model has been prepared for forecasting techniques. It gives general information related to forecasting methods, applications, stages and some models.
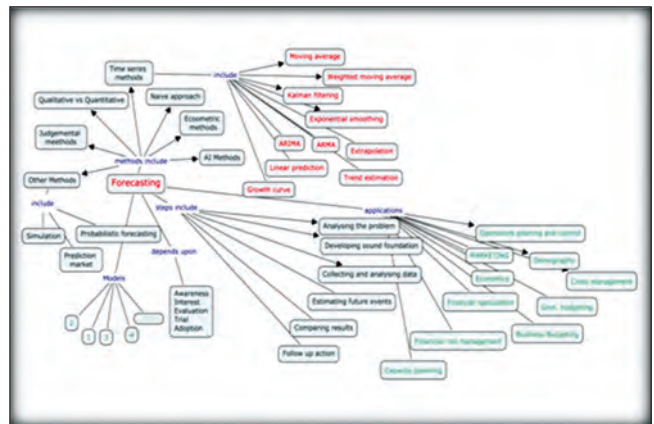


Knowledge model for forecasting techniques

## CBP Vortal

A Web site (Vortal) has been developed to facilitate the online management of all training programs under Centre of Advanced Faculty Training (CAFT), Summer-Winter Schools (SWS) and Short Courses (21/10 days duration) under Capacity Building Program (CBP) sponsored by Agricultural Education Division, ICAR. System is hosted at IASRI server and can be accessed from the URL http://iasri.res.in/cbp. Different modules have been created for different types of users (Trainee, Course Coordinator, Managers (DDG/ADG) and Vortal Administrator).
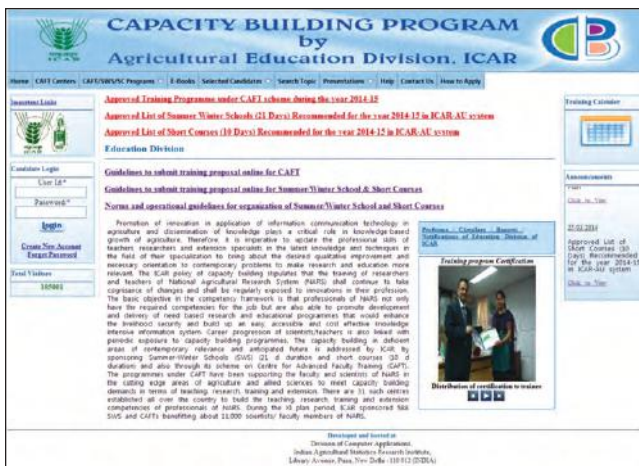


## Significant features of CBP Vortal

➢ Information about training programs (brochure, time table, course content etc.).

➢ Details of CAFT Centers.

➢ Work flow for training proposal submission by Course Coordinator and evaluation of proposal by Agricultural Education Division, ICAR.

➢ Submission of training related document (brochure/presentations/lecture file/photos) by Course Coordinator.

➢ Online submission of application for training program. Applicant can track the status of application.

➢ Course Director has access to reports on all trainees who applied in the program, selected participants, and evaluation by participants etc.

➢ List of selected trainees for different training programs on the Vortal.

➢ Managers (DDG/ADG) have access to many reports on funded training programs, selected participants

in different training programs, evaluation of training by participants, total participants in different disciplines, gender, state etc.

➢ Online availability of e-books/lecture notes of all the training programs.

➢ Full featured online help.

➢ Powerful administrative module.

Home page of vortal provides information to users on training programs organized by Education Division, ICAR.
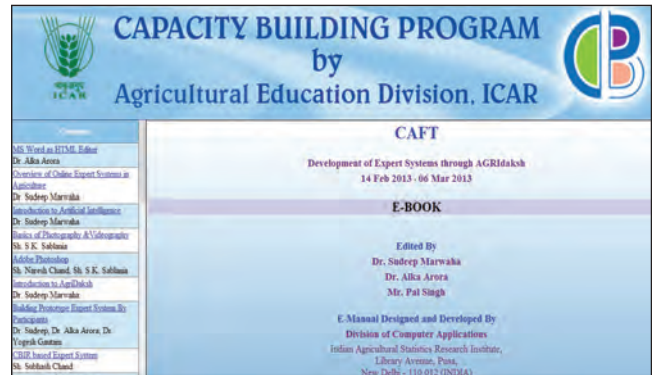


e-books module on Home Page

System has been formally launched by Dr. Arvind Kumar, DDG (Education), ICAR in the workshop "ICT for Capacity Building in Agricultural Education in India" organized by CAFT in Agricultural Statistics and Computer Application, IASRI on 26-27 July 2013. As per google analytics, vortal has been visited by 19000 users. This vortal will help in overall management of training programs funded by Education Division, ICAR.

## Online Decision Tree Classification (ODTC) using C4.5

ODTC is a web based software for rule generation and decision tree induction using C4.5 algorithm. The visualization in the form of tree structure enhances the understanding of the generated rules. The software contains the feature to impute the missing values in data. The input data can both be categorical and numerical in nature. The software can import txt, xls and csv data file formats. Enhanced waterfall model has been used for the software development process. This software will be useful for academicians, researchers and students working in the area of data mining, agriculture and other fields where huge amount of data is generated. The software has been developed and

transferred online at IASRI website on the web address proj.iasri.res.in/odtc/



Home Page of ODTC

| Rule_id | IF THEN RULES | Rows Covered |
|---|---|---|
| 1. | IF pl <= 2.45 THEN Iris-setosa | 50 |
| 2. | IF pl > 2.45 AND IF pl <= 4.95 AND IF sl > 4.95 THEN Iris-versicolor | 47 |
| 3. | IF pl > 2.45 AND IF pl > 4.95 AND IF pw > 1.75 THEN Iris-virginica | 18 |
| 4. | IF pl > 2.45 AND IF pl <= 4.95 AND IF sl <= 4.95 AND IF sw <= 2.45 THEN Iris-versicolor | 1 |
| 5. | IF pl > 2.45 AND IF pl <= 4.95 AND IF sl <= 4.95 AND IF sw > 2.45 THEN Iris-virginica | 1 |
| 6. | IF pl > 2.45 AND IF pl > 4.95 AND IF pw <= 1.75 AND IF sw <= 2.25 THEN Iris-virginica | 1 |
| 7. | IF pl > 2.45 AND IF pl > 4.95 AND IF pw <= 1.75 AND IF sw > 2.25 THEN Iris-versicolor | 2 |

Rules generated by ODTC
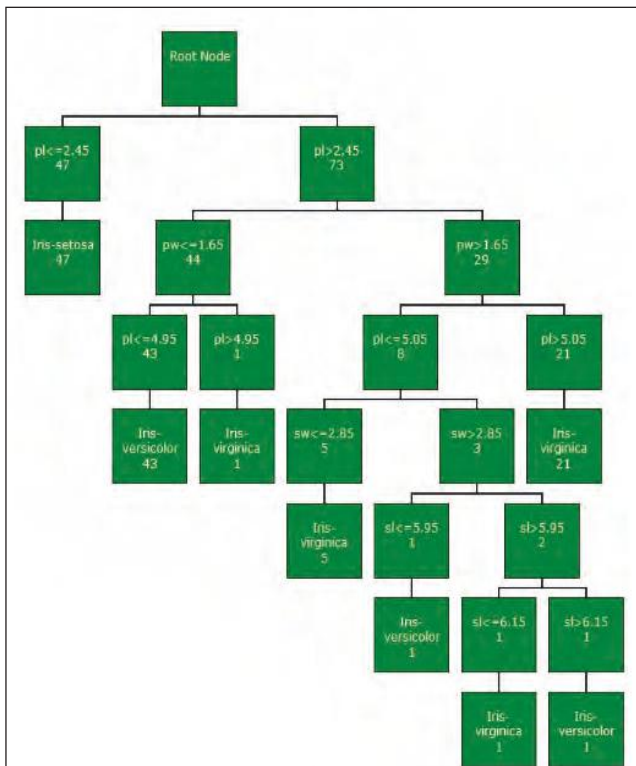


Decision tree visualization using ODTC

## Web based Fuzzy C-means Clustering Software (*w*FCM)

Fuzzy C-means is a well-known fuzzy clustering algorithm in literature. It allows objects to belong to several clusters simultaneously with different degrees of membership. Considering the importance of fuzzy clustering, a web based software has been developed to implement fuzzy C-means clustering algorithm (wFCM). This is a freely accessible web based software package for clustering datasets based on fuzzy C-means clustering algorithm. System is hosted at http://proj.iasri.res.in/wfcm/.



This software is completely menu driven and presents user-friendly GUI which is developed to minimize efforts in using the software. User can upload data to wFCM using different formats of Excel and csv file. Results can be visualized in graphical format and can be downloaded in excel and pdf format. The software will be useful for statisticians, researchers, students and teachers for clustering datasets from agricultural research as well as many diverse areas of other sciences.



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TM
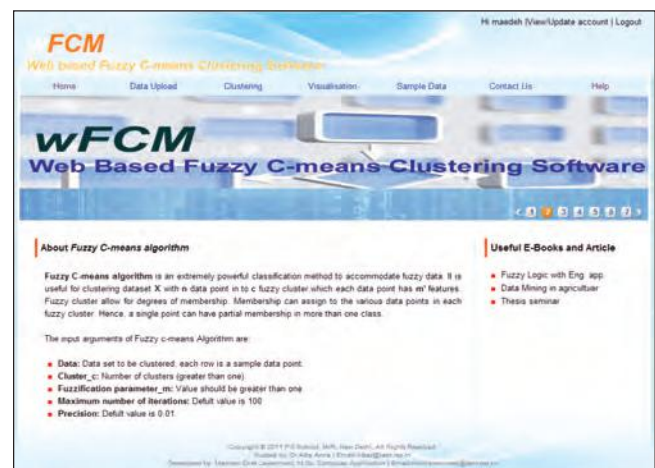
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Certificate No: Q-01131118

Issue Date: **18 Nov 2013**

2nd Surv. Due Before: **31 Oct 2015***

Original Issue Date: **18 Nov 2013**

1st Surv. Due Before: **31 Oct 2014***

Valid Till: **17 Nov 2016**

**\* After successful completion of surveillance audit, new certificate shall be issued.**

In the course of validity of the present certificate the enterprise management system must permanently satisfy the requirements of the international regulations. The fulfilment of these regulations will be regularly controlled by Equalitas Certifications Limited.

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# 4

# 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 from current academic year 2013-14 and M.Sc. in Bioinformatics since 2011-12. A brief description of human resource development during the year is given in the sequel.

## DEGREE COURSES

The Institute conducts 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)   M.Sc. (Bioinformatics)

The institute will start the degree course in Ph.D (Bioinformatics) from academic session 2014-15. Both Ph.D. and M.Sc. students of all the three courses are required to study courses not only in their major field, i.e. Agricultural Statistics, Computer Applications and Bioinformatics but also in Agricultural Sciences like Genetics, Agronomy, Agricultural Economics, etc. The Courses in Mathematics, Agricultural Statistics, Computer Application and Bioinformatics are offered at the Institute while the courses in Agricultural Sciences are offered at IARI.

**Number of students admitted / completed various courses during 2013-14**

| Courses | Number of Students | |
|---|---|---|
| | Admitted | Completed |
| Ph.D. (Agricultural Statistics) | 05 | 02 |
| M.Sc. (Agricultural Statistics) | 08 | 08 |
| Ph.D. (Computer Application) | 02 | - |
| M.Sc. (Computer Application) | 04 | 05 |
| M.Sc. (Bioinformatics) | 04 | 01 |

## DISSERTATIONS APPROVED

### Ph.D. (Agricultural Statistics)

i)   **Mohan Kumar TL**

**Development of statistical models using nonlinear support vector machine**

Statistical modelling plays a very important role in comprehending underlying relationships among crucial variables in an agricultural system. Several statistical models are developed using Nonparametric Nonlinear Support Vector Machine (SVM) methodology. SVM is a relatively new *Generalized portrait algorithm* proposed for solving problems in classification, function estimation and density estimation. Basic concepts of linear and nonlinear SVM and their formulation for binary

classification problems are discussed. Methodology for extending binary classification problem to multiclass classification problem is considered. Further, optimal hyper-parameters of this model are estimated using Particle Swarm Optimization (PSO) algorithm. As an illustration, this methodology is applied for classification of three varieties of banana based on their morphological characters. Result shows that the above methodology has performed the best vis-à-vis other competing methodologies for the data under consideration. Extension of SVM methodology to regression problem called as Support Vector Regression (SVR) is thoroughly studied. PSO technique is employed to estimate its optimal hyper-parameters. Superiority of this methodology is demonstrated over artificial neural network and multiple linear regression for maize crop yield data. Various hybrid models are developed to tackle complex time-series data by combining Linear Seasonal Autoregressive Integrated Moving Average (SARIMA) and Nonlinear SVR models for time-series forecasting. Optimal hyper-parameters of these models are estimated using PSO technique. Subsequently, as an illustration, these models are applied to all-India monthly marine products exports time-series data. Superiority of hybrid models over individual Linear SARIMA and Nonlinear SVR models is demonstrated for the data under consideration. Further, Least squares version of SVM, known as Least Squares Support Vector Machine (LS-SVM) methodology is thoroughly investigated. Optimal hyper-parameters of this model are estimated by employing PSO technique. As an illustration, the methodology is successfully illustrated for modelling and forecasting all-India monthly rainfall time-series data. Linear Kalman Filter (KF) and Nonlinear LS-SVM methodologies are also combined to develop various hybrid models for forecasting complex time-series data. PSO is employed for estimating optimal hyper-parameters of hybrid models. All-India monthly rainfall time-series data is considered to illustrate the superiority of developed hybrid models over individual Linear KF and Nonlinear LS-SVM methodologies. In order to achieve the above tasks, relevant computer programs are written in R and MATLAB software. Various software packages viz. R, MATLAB, SAS and STATISTICA are used to carry out data analysis.

**Guide: Dr. Prajneshu**

ii) **Arpan Bhowmik**

### Experimental designs involving treatments exhibiting interference effects

In agricultural field experiments, interference effects may arise from treatments applied in neighbouring units. These interference effects may also arise from the neighbouring units at distance 2, 3 and so on. Block model with interference effects from the neighbouring units up to distance 2 (or second order) has been studied. The information matrices for estimating direct as well as interference effects have been derived. Some classes of balanced and strongly balanced block designs with interference effects up to distance 2 have been obtained and their characterization properties have been studied. The designs so obtained are totally balanced for estimating direct and interference effects of treatments. Further, considering one-sided interference effects from left neighbouring units up to distance 2, universally optimal balanced and strongly balanced block designs for the estimation of direct effects and interference effects have also been identified. Besides interference effects, there may arise situations where trend effects may also affect the plots within block. Block models with interference effects from both adjacent neighbouring units and from neighbouring units up to distance 2 incorporating trend component have been studied. The information matrices for estimating direct as well as interference effects incorporating trend component along with the conditions for a block design with interference effects to be trend free have been derived. Series of totally balanced trend free designs have been obtained. Further, there may be situations where effects are no longer additive instead direct effects may interact with interference effects. Experimental setup for block designs with interference effects from neighbouring units on both sides under non-additive interference model has been discussed. Strongly balanced block designs with interference effects from immediate neighbouring units have been identified to be universally optimal for separate estimation of direct effects and interference effects (left and right) of treatments under the non-additive model. Considering one-sided interference effects, under block design setup left interference × direct effects non-additivity and direct effects × block effects

non-additivity have also been explored. Under these situations optimality aspects have also been studied.

**Guide: Dr. Seema Jaggi**

**M.Sc. (Agricultural Statistics)**

**i) Pradip Basak**

**Prediction of population total for skewed variable under a log transform model**

In many surveys (for example agriculture, business enterprises, income and expenditure surveys) data are typically skewed which contain few extreme values and linear model assumptions are questionable. For such data, the relationship between variable of interest and auxiliary variable may not be linear in the original (raw) scale, but can be linear in a transformed scale, e.g. the logarithmic (log) scale. In such cases it is expected that survey estimation based on a linear model will be inefficient and an appropriate technique for estimation of finite population should then be based on a linear model for a transformed version of that variable. Model calibration approach is a general approach of calibration which is appropriate for estimation of survey data in case of non-linear relationship between target variable and auxiliary variable. The interest is in estimation of survey variable which is skewed and therefore the model calibration approach can be useful for improving the precision of estimation. However, this approach is based on the assumption that study variable and its predicted value obtained through fitted super-population model is approximately linearly related even when study variable and auxiliary variable is non-linear. But, the predicted values used in model calibration approach are biased due to back transformation and consequently, the resulting estimators are also biased. A back transformation bias correction in the fitted values has been proposed, using a second order Taylor series approximation, to be used in this approach and developed the model-based model calibration estimator of population total for skewed data. The expression for its mean square error estimator is also obtained. The improved performance of proposed estimator as compared to existing estimators is demonstrated using a Monte Carlo simulation study. The developed estimator is also applied in a real life survey data.

**Guide: Dr. Hukum Chandra**

**ii) Sunil Kumar Yadav**

**Robust $2^k$ factorial designs with logistic error distribution**

In designed experiment, it is not always true that the error of the generated data follows the normal distribution which is one of the basic assumptions of analysis of variance. Under such situations, the maximum likelihood equations may not be linear and so they are not solvable. In this dissertation, the $2^k$ factorial experiment has been considered and the error in the model is assumed to be distributed as generalized logistic (non-normal distribution). Under the model of factorial experiments when error follows generalized logistic distribution, the maximum likelihood equations have been derived for obtaining the estimates of parameters. The equations obtained from the first derivative of log likelihood function with respect to parameters do not yield the explicit solutions for the estimates due to non-linearity of the function. Solving them by iterations is indeed problematic for reasons of (i) multiple roots, (ii) non-convergence of iterations, and (iii) convergence to wrong values. Therefore, methods have been developed using the modified maximum likelihood estimates in which the maximum likelihood equations are linearized by using the Taylor's expansion and estimates of the parameters are obtained. These estimates are called modified maximum likelihood estimates. These estimates are efficient under non-normal error distribution and asymptotic to maximum likelihood estimates. The model of factorial experiment is assumed to be fixed effect model and design considered is completely randomized design for equal number of observations per cell. The modified maximum likelihood estimates for all the effects (main effects and interaction effects) of $2^3$ factorial and the estimate of the error were obtained. *F* statistic was developed for all the treatment effects for testing the significance of parameters. These results have been generalized for the factorial experiments with *k* factors each at two levels. SAS code has been developed for the generation of data for $2^3$ factorial experiment in which error follows logistic distribution for different values of parameter *b*. The generated data has been analysed and compared the modified maximum likelihood procedure with the usual ANOVA procedure. Finally the size of the test is computed by using 5000 Monte Carlo runs for different values of *b*.

**Guide: Dr. Krishan Lal**

**iii) Arvind Kumar**

**Experimental designs under three-way blocking structure**

When heterogeneity present in the experimental material is from three sources, then three-way blocking of the experimental units is recommended for control/reduction of experimental error. For these situations, experimental designs under three-way blocking structure can be advantageously used. These designs are capable of marking out stony patches and other features that tend to clump in compact areas or similarity that may arise due to same group of housing of animals. Gerechte designs and Sudoku square designs are some popular and useful classes of such designs. To have a greater application potential, more classes of such designs are constructed to fit into various experimental situations. Here, eight series of designs under three-way blocking structure have been developed for regular regions. Out of these, two series of designs are structurally incomplete one having one empty node and the other having two empty nodes, in each region. Further, two more series of designs are structurally incomplete having either one or empty regions. Again, there are many trials where it is unrealistic to replicate every treatment the same number of times in a three-dimensional blocking setting. Three series of designs have been obtained for comparing two sets of treatments, one set consisting of test treatments and the other control treatment(s). Out of these three series, two series have one control treatment and the third one has two control treatments. Many a times the regions may be irregular, having no uniform shape and size. So, four methods of constructing designs under three way blocking structure for irregular regions have been developed in which two methods give structurally incomplete designs. Each method of construction has been illustrated with appropriate examples. Considering a four-way classified model, the information matrix for the estimation of treatment effects has been derived for designs under three-way blocking set up. Properties of these classes of designs have been studied and canonical efficiency factor of the designs constructed in comparison to an orthogonal design having same number of treatments has also been worked out. SAS codes have been developed using PROC IML to compute the information matrix, variances pertaining to different groups of treatment comparisons and efficiency factor.

**Guide: Dr. Cini Varghese**

**iv) Soumya Ranjan Bardhan**

**Identification of diverse core set of germplasm for abiotic stress tolerance in rice**

Knowledge of germplasm diversity among breeding material is an invaluable aid in crop improvement programs. Genetic diversity refers to variation within the individual gene locus/among alleles of a gene, or gene combination, between individual plants or between plant populations. With the availability of population of rice germplasm, it will be interesting to identify a core set of germplasm accessions representing the maximum diversity present in the population. These rice germplasm exhibits tolerance to different degree of abiotic stresses like heat, cold, moisture, salinity and submergence. With the advent of SNP genotyping technologies and availability of phenotypic traits performance of germplasm, the amount of information available an quantitative and qualitative traits is enormous and their number is much larger than the number of germplasm accessions or observations. Handling of such high dimensional mixture data remains a challenge for plant breeders to identify diversified core sets of germplasm. Also, only a subset of SNPs is associated with the phenotypic traits. Hence, an application of suitable variable selection methods for screening of significant SNPs associated with traits is essential. It is also necessary to identify suitable clustering procedure(s) and sampling strategies to identify maximal diversified core set from a population of germplasm with mixture data. Keeping this in view, the present study was taken up to select effective SNPs associated with the different phenotypic traits, to identify core set of germplasm by employing suitable combination of clustering method and sampling strategies and to compare the performance of diversity indices obtained from different core sets to identify core set with maximum diversity. The developed procedure is finally illustrated by using a data set with mixture data on salinity stress tolerance in rice germplasm accessions. The results reveal that the application of random forest and LASSO are useful to identify effective SNPs associated with the phenotypic

trait performance. Further, a combination of Ward's clustering method with Gower's distance and NY allocation method with at least 25% of sampling intensity is found suitable criterion to develop a maximal diversified core set of rice germplasm for salinity stress tolerance.

**Guide: Dr. AR Rao**

### v) Achal Lama

**A study on agricultural commodity price volatility using dynamic neural networks**

The ability to accurately forecast the price volatility of agricultural commodities is an important concern among both policy makers and farming community. In this study, an effort has been made to evaluate the forecasting performance of dynamic neural networks model with GARCH model for predicting the volatility using monthly price series of edible oils in domestic and international markets in terms of mean square error (MSE) and correct directional change. The aim of the study pertains to short term volatility forecasting up to one year with multiple forecast horizons. The neural network based models uniformly outperformed the GARCH model in predicting the direction of price volatility while performance based on mean square error provided mixed results. It is worth mentioning that studies have shown that MSE type measures may be inappropriate for comparing nonlinear models. Moreover, future direction of the market is more important in economics for capturing the business cycle movements. An effort was also made to investigate whether the forecasting performance of two competing models can be improved by non-linear kernel based combination of GARCH and neural networks based forecasts. The results of the study provided mixed results for combined forecasts compared to their components' performance which may be due to the limitation of using a fixed bandwidth, which largely determines the optimal weights of the combined model.

**Guide: Dr. GK Jha**

### vi) Himadri Shekhar Roy

**A study on outliers in factorial experiments**

Experiments in which two or more than two factors with two or more than two levels are tested together are called factorial experiments. In agriculture,

a huge number of data are generated through factorial experiments. Occurrence of outlier is very common where data collection is involved. It is also known that presence of outliers may cause serious problem leading to wrong conclusion. In the present investigation, Cook-statistic is developed for detecting outliers in factorial experiments. For developing this statistic, mean-shift model has been considered, *i.e.* mean of each of outlying observations is shifted from the mean of other observations. A general expression of cook-statistic for detecting any *t* observations has been obtained. The distribution of Cook statistic has also been obtained. A statistic known as outlier sum of squares or Q-statistic has also been developed for the same purpose. These developed statistics were applied to real experimental data. For applying data in Cook-statistic both single and paired observations have been considered and outlying observation(s) are detected. Analysis has been done on the original data. Then analysis was carried out by replacing the outliers by their missing value estimates. The significant differences in the analysis were noted. For detecting outlier, appropriate programs are written in SAS/IML.

**Guide: Dr. LM Bhar**

### vii) Shwetank Lall

**A study of Tweedie family of distribution for rainfall modelling**

The present study deals with the investigation of behaviour of monthly rainfall data. There are many exact zeroes in the rainfall recording of a month over a period of years. Probability distributions currently in use are not able to combine the discrete aspect of getting an exact zero reading of rainfall in a month and the aspect of amount of rainfall in the same month. Compound Poisson Tweedie distribution, however provides a better way to combine both the aspects in one probability distribution. In this work the compound Poisson Tweedie distribution has been used to fit the monthly rainfall data by computing the estimates of its parameters. For the purpose of estimation of parameters of compound Poisson Tweedie distribution a new algorithm has been developed and used in this work. Another approach to model monthly rainfall is modified gamma distribution with singularity at zero. This is a three parameter mixture distribution which gives

a probability mass to the occurrence of zero in a month and defines a conditional density for the amount of rainfall. The parameters are estimated by developing an algorithm. For testing the goodness of fit of the distributions Kolmogorov-Smirnov test is used. Since the test requires the complete continuity of the distributions in their domain, the theoretical distribution function for both the distributions were computed by using trapezoidal rule of numerical integration. The test shows that both the distributions are good for fitting the monthly rainfall data. In this investigation bootstrap technique has been employed to know the distribution of Kolmogorov-Smirnov test statistic. The bootstrap technique provides the relative goodness of fit of the proposed distribution. Thus it can be concluded that the Tweedie family of distributions are good for fitting rainfall months with few or many zero readings.

**Guide: Dr. Himadri Ghosh**

**viii) Satish Kumar Yadav**

**Calibration estimator in presence of quadratic relationship between study and auxiliary variable**

The calibration approach is frequently used to obtain calibrated weight by incorporating auxiliary information into original design weight. The calibration approach uses some constraints to obtain calibrated weights. Generally, a linear relationship exists between study and auxiliary variable. But in many surveys, the variables are not linearly related; some kind of nonlinear relationship exists between the study and auxiliary variable. In many agricultural experiments relationships between variables are not linear, rather non-linear relationship may exist with an intermediate optimum (which may be a maximum or a minimum depending upon the relationship). The calibration approach is used to develop an estimator to take care of the situation where a quadratic relationship exist between study and auxiliary variables. The variance of the estimator and estimator of variance are also developed. A simulation study has been carried out to demonstrate the improved performance of the proposed calibration approach based estimator over the ratio, regression and Horvitz-Thompson estimator in presence of quadratic relationship between study and auxiliary variable. The simulation study is carried out over different sample sizes, for different values of

correlation coefficient between study and auxiliary variable using two different distributions for auxiliary variable *and* using different coefficient values of the quadratic coefficient. Through the simulation study it is found that the proposed calibration estimator is more precise than ratio, regression and Horvitz-Thompson estimator. With respect to the correlation, the proposed estimator is more precise when there is a higher correlation between study and auxiliary variable. The efficiency of the proposed estimator increases with the increase in the sample sizes.

**Guide: Sh. SD Wahi**

**M.Sc. (Computer Application)**

**i)   M Rajeshwar Singh**

**Web based software for feature selection using rough theory**

Rough set theory was proposed by Zdzislaw Pawlak in the early 1982 and is now in a state of constant development. It deals with the classificatory analysis of data tables. The main goal of the rough set analysis is to synthesize approximation of concepts from the acquired data. Its methodology is concerned with the classification and analysis of imprecise uncertain or incomplete information. It is considered as one of the first non-statistical approach in data analysis. WEBSFS-RST software is developed on the principle of rough set concept. Rough sets are applied in many domains, for instance in machine learning, knowledge discovery, artificial intelligence, medicine, data mining, expert systems, etc. It helps to find minimal sets of data with the same knowledge as in the original data called the reduct. WBSFS-RST is an online software which is based on the concept of rough set theory so it can perform various operations related to the properties of rough set. The main task is to generate reduct of an information system. Finding reduct is a NP hard problem. WBSFS-RST can generate optimal reduct for an average size dataset containing up to 100 ROWS. No online software has been found to compute reduct so far. There is no need of formal training or any programming expertise for using WBSFS-RST. The software has proper security authentication. The system has been tested with different datasets and the results matched with the calculated reducts in the literature.

**Guide: Dr. Rajni Jain**

**ii) Suvajit Das**

**Online decision tree classification using C4.5 algorithm**

Data mining is a step of knowledge discovery in databases, performing several tasks such as classification, regression, clustering, association rule mining, outlier detection, etc. Classification is one of the most important and widely carried out tasks of data mining. It is a predictive modelling task which is defined as building a model for the target variable as a function of the explanatory variables. There are many well established techniques for classification out of which, decision tree is a very important and popular technique from the machine learning domain. Decision tree is a decision support tool that uses a tree-like graph or model of decisions and their possible consequences, including chance event outcomes, resource costs and utility. C4.5 is a well known decision tree algorithm used for classifying datasets. The C4.5 algorithm is Quinlan's extension of his own ID3 algorithm for decision tree classification. It induces decision trees and generates rules from datasets, which could contain categorical and/or numerical attributes. The rules could be used to predict categorical values of attributes from new records. C4.5 performs well in classifying the dataset as well as generating useful rules. In this study a web based software for rule generation and decision tree induction using C4.5 algorithm has been developed. The visualization in the form of tree structure enhances the understanding of the generated rules. The software contains the feature to impute the missing values. The enhanced waterfall model has been used for the software development process. This software is useful for academicians, researchers and students working in the area of data mining, agriculture and other fields where huge amount of data is generated.

**Guide: Ms. Shashi Dahiya**

**iii) Sarita Kumari**

**Development of online software for computation of Malmquist index**

Productivity growth in agriculture is both necessary and sufficient condition for its development and has remained a serious concern for intense research over the last five decades. Malmquist Index is an important measure to quantify the productivity growth. Malmquist Index is used to measure the total factor productivity change between two data points by calculating the ratio of distances of each data point relative to a common technology. Modules for Malmquist Index computation are not available in any online software and commonly used econometric packages. In this thesis an attempt is made to design and develop Online Software for Computation of Malmquist Index (*MalmSoft*).

*MalmSoft* has been designed and developed as per web based three-tier architecture. Software is developed in Microsoft .NET environment. The User interface layer is implemented using combination of HTML, JavaScript and CSS. ASP.NET 4.0 and C#.NET is used for writing business logic. Database Layer is implemented for user management in MS Access. Being web based, *MalmSoft* is freely accessible software for Malmquist Index. Software is completely menu driven and offers user-friendly screens to reduce efforts in understanding the software. The software provides functionality for computation of distance function and Malmquist Index for an agricultural firm from one time period to another time period. User can register, login, compute Malmquist index and see the results as well as can save result in excel file. Software results are validated using a suitable dataset whose results have been compared with standard software DEAP. This software will be useful for agricultural researchers engaged in research in agricultural economics and allied sciences.

**Guide: Dr. Alka Arora**

**iv) Kamalika Nath**

**Expert system on solanaceous crops under protected cultivation**

Protected cultivation technology is a new technology in agricultural sciences for our country. Most of the farmers do not know about this new technology of crop cultivation. Solanaceous crops particularly tomato and capsicum are important vegetable crops in India grown under protected condition. Availability of experts on protected cultivation for solanaceous crops is rare. So, there is a need for developing an online expert system to disseminate

need based knowledge on solanaceous crops under protected cultivation to the farmers to help them to increase the efficiency for crop management and to increase the yield. Expert system on solanaceous crops under protected cultivation is designed to help farmers to take appropriate decisions and disseminate need based research findings to millions of the farmers at a time. The system uses Ontology as its knowledgebase and provides the user with the result based on the recent knowledge. This framework does not pose any restriction on the domain experts for regular updating and modification of the underlying ontology. The system has been developed with robust JAVA technology and uses MS SQL Server 2008 as database and uses the inferencing capabilities of JENA, a semantic web tool kit. The system currently has information of about 17 diseases, 6 insects and 4 types of protective structures of Tomato and Capsicum crops. The system works in question-answer mode and allows the farmers to choose options for each of the question asked. At each level the text is supported by pictures. The system has a dynamic knowledgebase and acts as a tool for transferring the site and crop specific knowledge of various domain experts to the farmers.

**Guide: Dr. Sudeep Marwaha**

**v)  Tanuj Misra**

**Non-destructive phenotyping of rice plant through image analysis**

Leaf area and chlorophyll content are considered as most important agronomic parameters for studying physiological features related to plant growth, photosynthetic and transpiration process etc. Manual chlorophyll extraction procedure and leaf area measurement with leaf area meter are accurate but are destructive, laborious, time consuming and relatively expensive. High-throughput image analysis for automated phenotyping is used to extract phenotypic parameters related to chlorophyll content and leaf-area of the plant which saves time and effort. With the increase in information availability, there is an immense need for creation of information system for storage, browsing and sharing of the online data generated by phenomics facility and offline data collected by experimenters and experimental

metadata. No freely open source software for high-throughput image analysis is available. There exists a clear need to develop an image analysis tool for phenotyping of plant. Rice crop is selected for phenomics in this work because of its importance as a major food crop. The web based software "NPRIA" for estimation of non-destructive phenotypic parameters for chlorophyll content and leaf area of rice plant is based on the N-tier architecture, developed using NetBeans 7.0.11 IDE, Java Server Pages (JSP), ImageJ API, and MS SQL Server 2008.  The two proposed models namely Artificial Neural Networks (ANNs) feed forward back propagation and linear regression model are used to predict chlorophyll content (with RMSE 0.001) and leaf area (with correlation coefficient 0.56) of the rice plant respectively based on image analysis.

**Guide: Dr. PK Malhotra**

**M.Sc. (Bioinformatics)**

**i)  Chiranjub Sarkar**

**Understanding of protein structure of different Pi54 alleles and their *in silico* interactions with Avr-Pi54 protein**

Rice blast disease caused by the fungus Magnaporthe oryzae, is one of the most widespread and devastating diseases of rice. Rice and M. oryzae constitute a typical gene-for-gene system, where the Pi54 gene product of the rice plant interacts with the Avr-Pi54 product from the pathogen. The interaction between blast resistance gene Pi54 and Avr-Pi54 at their protein level leads to resistance response in the rice plant. The objective of present study was to understand the effect of SNPs and InDels on the protein structure and its interaction with Avr-Pi54 protein. Large number of SNPs and InDels were found in the nucleotide sequences of the Pi54 alleles which affected secondary structure of the proteins. The tertiary structure of the proteins of Pi54 alleles were compared to the protein of original Pi54 gene in terms of atomic structure and quantitative assessment of the protein structures. The type and numbers of secondary structures were observed to be different in the tertiary protein structure of Pi54 alleles than the original Pi54 protein derived from rice line Tetep. The stabilization of the Pi54 proteins structure

fold was assessed depending on secondary structure, the numbers of h-bonds and the global free minimum energy. The protein structures of different alleles were considerably affected by SNPs and InDels thus affecting their phenotypes. The protein structure of resistance alleles were structurally more stable and hydrophilic compared to the susceptible alleles. The interactions of the Pi54 proteins of the alleles with Avr-Pi54 protein were also affected by the presence of SNPs and InDels in Pi54 allele. Out of 74 Pi54:Avr-Pi54 protein combinations, successful interaction was obtained between 52 proteins of Pi54 alleles and Avr-Pi54 protein. In case of Pi54 proteins of susceptible alleles the interaction was influenced by SNPs and InDels present in the alleles of Pi54 protein. The best interaction was obtained in case of Pi54 and Avr-Pi54. This study showed that not only SNPs/InDels in LRR region, but in other region of the protein lead also to the change in 3D structures of the Pi54 proteins which affects its interaction potential with the Avr-Pi54 protein.

**Guide: Dr. TR Sharma**

## 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

Institute of the Council, State Agricultural Universities and State Government Departments, etc. 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, 2013 to Nov. 23, 2013. The Course comprised of two independent modules of three months duration each. Module – I was organized during June 17, 2013 to August 17, 2013. Module-II was organized during September 2, 2013 to November 23, 2013. Two officers participated in Module – I and II. The courses covered under both the modules are

| Topic | Instructor |
|---|---|
| **Module – I** | |
| Statistical Methods | Sh. SD Wahi /Sh. Arpan Bhowmik, Prabina Kumar Meher |
| Official Agricultural Statistics | Dr. AK Gupta |
| Use of Computer in Agricultural Research | Dr. Amrit Kumar Paul, Md. Wasi Alam, Sh. Pal Singh |
| **Module – II** | |
| Sampling Techniques | Dr. KK Tyagi, Dr. AK Gupta |
| Econometrics and Forecasting Techniques | Dr. Prawin Arya, Md. Wasi Alam, Dr. Sanjeev Panwar |
| Design of Experiments | Sh. NK Sharma, Dr. Eldho Varghese |

## NATIONAL/INTERNATIONAL TRAINING PROGRAMMES
### Summary of Training Programmes Organised

| Category | No. of Training Programmes | No. of Participants |
|---|---|---|
| CAFT | 5 | 123 |
| Summer/Winter School | 2 | 39 |
| NAIP | 6 | 143 |
| Resource Generation | 3 | 79 |
| Others | 5 | 89 |
| **Total** | **21** | **473** |

## Details of Training Programmes Organised

| S. No. | Title | Venue | Duration | Sponsored by | No. of Participants |
|---|---|---|---|---|---|
| **Centre of Advanced Faculty Training** | | | | | |
| 1. | Recent Advances in Statistical Modelling Techniques<br>Course Director        : Ranjit Kumar Paul<br>Course Co-Directors   : Bishal Gurung,<br>                              AK Paul | IASRI, New Delhi | 31 May- 20 June 2013 | Education Division, ICAR | 25 |
| 2. | Advances in Statistical Genetics<br>Course Director        : Wasi Alam<br>Course Co-Directors   : Ranjit Kumar Paul,<br>                              AK Paul | IASRI, New Delhi | 02-22 July 2013 | Education Division, ICAR | 25 |
| 3. | Advances in Statistical Methods for  Animal Experiments<br>Course Director        : Susheel Kumar Sarkar<br>Course Co-Directors   : Anil Kumar, Krishan Lal | IASRI, New Delhi | 01-21 October 2013 | Education Division, ICAR | 25 |
| 4. | Advances in Experimental Designs for Development of Technologies in Agriculture<br>Course Director        : Eldho Varghese<br>Course Co-Directors   : Sukanta Dash,<br>                              Arpan Bhowmik | IASRI, New Delhi | 23 October to 12 November 2013 | Education Division, ICAR | 25 |
| 5. | Computational and Statistical Advances in Bioinformatics for 'Omics' Data<br>Course Director        : SB Lal<br>Course Co-Director    : Sanjeev Kumar | IASRI, New Delhi | 21 January to 10 February 2014 | Education Division, ICAR | 23 |
| **Summer/Winter School** | | | | | |
| 6. | Summer School on Forecast Modeling in Crops<br>Course Director:  KN Singh<br>Course Co-Directors   : Wasi Alam,<br>                              Praveen Arya,<br>                              Sanjeev Panwar | IASRI, New Delhi | 03-23 September 2013 | Education Division, ICAR | 19 |
| 7. | Winter School on Development of  Web Application for Agricultural Information Management<br>Course Director        : Alka Arora<br>Course Co-Directors   : Sudeep Marwah,<br>                              Shashi Dahiya | IASRI, New Delhi | 19 November  to 09 December 2013 | Education Division, ICAR | 20 |
| **National Agricultural Innovative Project** | | | | | |
| 8. | Data Analysis using SAS<br>Course Director        : Rajender Parsad | IASRI, New Delhi | 28-29 June 2013 | NAIP | 21 |
| 9. | Advanced User training of CLC Bio-software (Expert Faculty from Sweden Dr Igor Kardailsky and Dr Holger Karas, Senior Field Application Scientist)<br>Coordinator             : Dinesh Kumar | IASRI, New Delhi | 29 October to 01 November 2013 | NAIP | 30 |
| 10. | Data Analysis Using SAS<br>Course Director        : Rajender Parsad<br>Course Co-Directors   : LM Bhar,<br>                              Sanjay Srivastava<br>                              (IISS, Bhopal),<br>                              G. Somasundaram<br>                              (IISS, Bhopal) | IISS, Bhopal | 09-13 December 2013 | NAIP | 31 |

| 11. | Data Analysis using SAS<br>Course Director : Rajender Parsad | IASRI, New Delhi | 29 January to 05 February 2014 | NAIP | 23 |
|---|---|---|---|---|---|
| 12. | Computational Aspect for NSG Data Analysis: A Sojoum from Lab to Field at Ome Research Facility under NABG<br>Course Director : Dinesh Kumar<br>Course Co-Director : Mir Asif Iquebal | AAU, Anand | 04-13 March 2014 | NAIP | 20 |
| 13. | Advanced Analytical Techniques in Bioinformatics under Bioprospecting of genes and allele mining for abiotic stress tolerance<br>Course Director : AR Rao<br>Course Co-Directors : SD Wahi, Sudeep Marwah, PK Meher | IASRI, New Delhi | 10-19 March 2014 | NAIP | 18 |
| **Resource Generation** | | | | | |
| 14. | Data Analysis and Interpretation for ISS Probationers of XXXIV Batch<br>Course Director: Rajender Parsad<br>Course Co-Directors : Cini Varghese, BN Mandal | IASRI, New Delhi | 03-21 June 2013 | Central Statistical Office, Ministry of Statistics & Programme Implementation | 31 |
| 15 | Integrated Sample Survey Methodology (Refresher Course)<br>Course Director : Hukum Chandra<br>Course Co-Director : Kaustav Aditya | IASRI, New Delhi | 20-24 January 2014 | Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Government of India | 24 |
| 16. | Integrated Sample Survey Methodology (Refresher Course)<br>Course Director : Hukum Chandra<br>Course Co-Director : Kaustav Aditya | IASRI, New Delhi | 03-07 March 2014 | Department of Animal Husbandry, Dairying & Agriculture, Government of India | 24 |
| **Others** | | | | | |
| 17. | Data Base Management System (For Technical Personnel)<br>Course Director : RC Goyal | IASRI, New Delhi | 08-12 April 2013 | ICAR | 20 |
| 18. | One Day Training Programme (Study Visit) on Functions and Activities of IASRI<br>Coordinator : Seema Jaggi | IASRI, New Delhi | 06 December 2013 | National Academy of Statistical Administration (NASA) | 24 |
| 19. | Statistics Module of the Subject Matter Training for Scientists from Islamic Republic of Afghanistan<br>Coordinator : Seema Jaggi | IASRI, New Delhi | 15-22 January, 2014 | IARI, New Delhi | 04 |
| 20. | Training Workshop on Computer Assisted Text Analysis under "Mapping the Cultural Authority of Science across Europe and India (MACAS-EU & INDIA)".<br>Coordinator : KN Singh | IASRI, New Delhi | 27-29 March 2014 | Indian Council of Social Science Research (ICSSR) | 18 |
| 21. | Modular Course on Statistical Methods for Agricultural Research for the participants of an International M.Sc. Programme for Afghan Nationals on Teaching of Post-Graduate courses in Agronomy<br>Coordinators : Rajender Parsad, Eldho Varghese, Sukanta Dash | IASRI, New Delhi | 11 March to 03 April 2014 | IARI, New Delhi | 23 |

**Faculty Members of PG School, IARI in Agricultural Statistics**

| S. No. | Name | Year of Induction |
|---|---|---|
| 1. | Dr. UC Sud, Director (A) & Principal Scientist | 1995 |
| 2. | Dr. VK Gupta, National Professor | 1984 |
| 3. | Dr. Rajender Parsad, Principal Scientist, Head (Design of Experiments) & Professor (Agricultural Statistics) | 1995 |
| 4. | Dr. Prajneshu, Principal Scientist, Head (Statistical Genetics) & Professor (Bioinformatics) (till 31.07.2013) | 1984 |
| 5. | Dr. Anil Rai, Principal Scientist & Head (CABin) | 1995 |
| 6. | Dr. KN Singh, Principal Scientist & Head (F&ASM) | 2011 |
| 7. | Dr. Ranjana Agrawal, Principal Scientist (till 31.07.2013) | 1988 |
| 8. | Sh. SD Wahi, Principal Scientist | 1987 |
| 9. | Dr. KK Tyagi, Principal Scientist | 1995 |
| 10. | Dr. Krishan Lal, Principal Scientist | 2003 |
| 11. | Dr. RL Sapra, Principal Scientist (at IARI) (till 31.12.2013) | 2002 |
| 12. | Dr. Seema Jaggi, Principal Scientist | 1995 |
| 13. | Dr. Lal Mohan Bhar, Principal Scientist | 1998 |
| 14. | Dr. Amrit Kumar Paul, Principal Scientist | 1998 |
| 15. | Dr. Tauqueer Ahmad, Principal Scientist | 1998 |
| 16. | Dr. AR Rao, Principal Scientist | 1998 |
| 17. | Dr. Ramasubramanian V, Senior Scientist (till 18.07.2013) | 1999 |
| 18. | Dr. Girish Kumar Jha, Principal Scientist (at IARI) | 1999 |
| 19. | Dr. Cini Varghese, Senior Scientist | 2000 |
| 20. | Dr. Himadri Ghosh, Principal Scientist | 2004 |
| 21. | Dr. Prachi Misra Sahoo, Senior Scientist | 2002 |
| 22. | Dr. Hukum Chandra, Senior Scientist | 2003 |
| 23. | Dr. Amrender Kumar, Senior Scientist | 2003 |
| 24. | Md. Wasi Alam, Scientist | 2003 |
| 25. | Dr. Prawin Arya, Senior Scientist | 2003 |
| 26. | Dr. Anil Kumar, Senior Scientist | 2010 |
| 27. | Dr. Sanjeev Panwar, Scientist | 2011 |
| 28. | Dr. Ranjit Kumar Paul, Scientist | 2011 |
| 29. | Dr. Mir Asif Iqubal, Scientist | 2011 |
| 30. | Dr. BN Mandal, Scientist | 2011 |
| 31. | Dr. Susheel Kumar Sarkar, Scientist | 2011 |
| 32. | Dr. Eldho Varghese, Scientist | 2011 |
| 33. | Dr. Kaustav Aditya, Scientist | 2012 |
| 34. | Dr. Bishal Gurung, Scientist | 2013 |
| 35. | Dr. Sukanta Dash, Scientist | 2013 |

**Faculty Members of PG School, IARI in Computer Application**

| S. No. | Name | Year of Induction |
|---|---|---|
| 1. | Dr. PK Malhotra, Professor (Computer Application) | 1991 |
| 2. | Dr. RC Goyal, Principal Scientist (till 30.06.2013) | 1995 |
| 3. | Dr. Alka Arora, Senior Scientist | 2001 |
| 4. | Dr. Sudeep, Senior Scientist | 2002 |
| 5. | Ms. Shashi Dahiya, Scientist | 2001 |
| 6. | Md. Samir Farooqi, Scientist | 2001 |
| 7. | Sh. KK Chaturvedi, Scientist | 2002 |
| 8. | Ms. Anu Sharma, Scientist | 2004 |
| 9. | Sh. SN Islam, Scientist | 2004 |
| 10. | Sh. SB Lal, Scientist | 2004 |
| 11. | Dr. Anshu Bhardwaj, Scientist | 2004 |
| 12. | Dr. Sangeeta Ahuja, Scientist | 2002 |
| 13. | Dr. Rajni Jain, Principal Scientist (at NCAP) | 2007 |
| 14. | Sh. Pal Singh, Scientist | 2010 |
| 15. | Sh. Yogesh Gautam, Scientist | 2012 |

**Faculty Members of PG School, IARI in Bioinformatics**

| S. No. | Name | Year of Induction |
|---|---|---|
| 1. | Dr. Anil Rai, Professor (Bioinformatics) & Head (CABin) | 2010 |
| 2. | Dr. Prajneshu, Principal Scientist & Head, Statistical Genetics (till 31.07.2013) | 2010 |
| 3. | Dr. KC Bansal, Director, NBPGR | 2010 |
| 4. | Dr. Rajender Parsad, Principal Scientist and Head (Design of Experiments) | 2010 |
| 5. | Dr. Seema Jaggi, Principal Scientist | 2010 |
| 6. | Dr. AR. Rao, Principal Scientist | 2010 |
| 7. | Dr. Sudeep, Senior Scientist | 2010 |
| 8. | Sh. SB Lal, Scientist | 2010 |
| 9. | Md. Samir Farooqi, Scientist | 2010 |
| 10. | Ms. Anu Sharma, Scientist | 2010 |
| 11. | Dr. TR Sharma, Principal Scientist | 2010 |
| 12. | Dr. T Mahapatra, Principal Scientist | 2010 |
| 13. | Dr. Kishore Gaikwad, Senior Scientist | 2010 |
| 14. | Dr. RL Sapra, Principal Scientist (till 31.12.2013) | 2010 |
| 15. | Dr. T Napolean, Senior Scientist | 2010 |

| 16. | Dr. PK Singh, Senior Scientist | 2010 |
|---|---|---|
| 17. | Dr. PS Pandey, Principal Scientist | 2010 |
| 18. | Dr. KV Bhat, Principal Scientist | 2010 |
| 19. | Dr. SS Marla, Principal Scientist | 2010 |
| 20. | Dr. Sunil Archak, Senior Scientist | 2010 |
| 21. | Dr. DC Mishra, Scientist | 2010 |
| 22. | Dr. Sarika, Scientist | 2010 |
| 23. | Sh. Sanjeev Kumar, Scientist | 2010 |
| 24. | Dr. Mir Asif Iquebal, Scientist | 2013 |
| 25. | Dr. Monendra Grover, Senior Scientist | 2013 |

**Research Fellowships**

During 2013-14, 19 Ph.D. and 34 M.Sc. students received research fellowship. 16 Ph.D. students received IASRI fellowship at the rate of Rs.10,500/- p.m. in addition to Rs 10,000/- per annum as the contingent grant .

01 Ph.D.(Agricultural Statistics) student received ICAR SRF Scholarship @12,000/- p.m. in addition to Rs.10,000/- per annum as contingent grant.

02 Ph.D. (Agricultural Statistics) students received DST-Inspire scholarship @18,000/-+30% H.R.A. 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 21 M.Sc. students received IASRI fellowship at the rate of Rs.7560 /- p.m. in addition to Rs. 6000 /- per annum as the contingent grant.

**Strengthening of Post Graduate Programme**

On the basis of funds received from 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 objectives 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:

- Course Management
- Student Management
- Faculty Management
- Administration Management
- E-Learning

**Courses taught during the Academic Year 2012–13 in Agricultural Statistics**

| Trimester - III | | | | |
|---|---|---|---|---|
| **Code** | **Course Title** | **Credits** | | **Instructor** |
| | | L | P | |
| PGS 504 | Basic Statistical Methods in Agriculture | 2 | 1 | Ramasubramanian, V, Susheel Kumar Sarkar, Kaustav Aditya |
| AS 503 | Basic Sampling and Non-parametric Methods | 2 | 1 | Hukum Chandra, LM Bhar, Anil Rai |
| AS 563 | Statistical Inference | 4 | 1 | Rajender Parsad, KN Singh, GK Jha |
| AS 564 | Design of Experiments | 3 | 1 | Seema Jaggi, VK Gupta, BN Mandal |
| AS 566 | Statistical Genetics | 3 | 1 | AK Paul, SD Wahi |
| AS 608 | Advanced Bioinformatics | 2 | 1 | AR Rao, M Grover, DC Mishra |
| AS 662 | Advanced Designs for Multi-factor Experiments | 2 | 1 | Krishan Lal, Rajender Parsad, Eldho Varghese |
| AS 664 | Inferential Aspects of Survey Sampling and Analysis of Survey Data | 2 | 1 | UC Sud, Anil Rai, Hukum Chandra |
| AS 667 | Forecasting Techniques | 1 | 1 | Amrender Kumar, Wasi Alam |
| AS 691 | Seminar | 1 | 0 | Sanjeev Panwar |

## Courses taught during the Academic Year 2013–14 in Agricultural Statistics

| Code | Course Title | Credits | | Instructor |
|------|-------------|---------|---|-----------|
| | | **L** | **P** | |
| PGS 504 | Basic Statistical Methods in Agriculture | 2 | 1 | KK Tyagi, AK Gupta, Eldho Varghese |
| 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, Anil Kumar |
| 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 | GK Jha, Prawin Arya |
| AS 569 | Planning of Surveys/Experiments | 2 | 1 | KK Tyagi, BN Mandal, Rajender Parsad |
| AS 600 | Advanced Design of Experiments | 1 | 1 | Rajender Parsad, Cini Varghese |
| AS 601 | Advanced Sampling Techniques | 1 | 1 | Hukum Chandra, Prachi Mishra Sahoo |
| AS 602 | Advanced Statistical Genetics | 1 | 1 | AK Paul, SD Wahi |
| AS 603 | Regression Analysis | 1 | 1 | LM Bhar, RK Paul |
| AS 604 | Linear Models | 2 | 0 | Krishan Lal, VK Gupta |
| AS 606 | Optimization Techniques | 1 | 1 | Amrender Kumar,RK Paul |
| AS 691 | Seminar | 1 | 0 | Bishal Gurung |

| | Trimester - II | | | |
|------|-------------|---------|---|-----------|
| PGS 504 | Basic Statistical Methods in Agriculture | 2 | 1 | KK Tyagi, Krishan Lal, Amrender Kumar |
| AS 502 | Basic Design of Experiments | 2 | 1 | Susheel Kumar Sarkar, Anil Kumar, Sukanta Dash |
| AS 551 | Mathematical Methods in Statistics | 4 | 0 | Cini Varghese, NK Sharma, Sukanta Dash |
| AS 562 | Advanced Statistical Methods | 2 | 1 | Seema Jaggi, Arpan Bhowmik |
| AS 565 | Sampling Techniques | 3 | 1 | Tauqueer Ahmad, Prachi Mishra, Kaustav Aditya |
| AS 570 | Statistical Modeling | 2 | 1 | RK Paul, Bishal Gurung |
| AS 571 | Bioinformatics | 3 | 1 | TR Sharma, AR Rao, Sunil Archak, Rajender Parsad |
| AS 573 | Demography | 2 | 0 | Bishal Gurung, AK Gupta |
| AS 605 | Advanced Statistical Inference | 1 | 1 | KN Singh, LM Bhar |
| 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 Kumar |

## Courses taught during the Academic Year 2012–13 in Computer Application

| Code | Course Title | Credits | | Instructor |
|------|-------------|---------|---|-----------|
| | Trimester - III | | | |
| | | **L** | **P** | |
| CA 503 | Statistical Computing in Agriculture | 1 | 2 | Krishan Lal, Mir Asif Iquebal, Rajender Parsad |
| CA 563 | Operating System | 2 | 1 | Soumen Pal, Yogesh Gautam |
| CA 567 | Computer Networks | 2 | 1 | SN Islam |
| CA 568 | Software Engineering | 2 | 0 | Rajni Jain, Anu Sharma |
| CA 571 | Modeling and Simulation | 2 | 1 | PK Malhotra, Anshu Bharadwaj |
| CA 691 | Seminar | 1 | 0 | Shashi Dahiya |

## Courses taught during the Academic Year 2013–14 in Computer Application

| Trimester - I | | | | |
|---|---|---|---|---|
| Code | Course Title | Credits | | Instructor |
| | | L | P | |
| CA 502/ BI 502 | Introduction to Computer Application | 1 | 1 | Samir Farooqi, SN Islam |
| CA 551/ BI 503 | Mathematical Foundations in Computer Application | 4 | 0 | NK Sharma, Sukanta Dash |
| CA 552 | Computer Oriented Numerical Methods | 2 | 1 | Pal Singh |
| CA 560 | Computer Organization and Architecture | 3 | 0 | Shashi Dahiya, Yogesh Gautam |
| 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 570 | Computer Graphics | 2 | 1 | Anshu Bharadwaj, Pal Singh |
| CA 575 | Artificial Intelligence | 2 | 1 | Rajni Jain, Sudeep |
| CA 611 | Design and Analysis of Algorithms | 2 | 1 | Yogesh Gautam |
| CA 621 | Advances in Data Mining | 2 | 1 | Anshu Bharadwaj, Alka Arora |
| CA 691 | Seminar | 1 | 0 | SN Islam |
| Trimester - II | | | | |
| Code | Course Title | Credits | | Instructor |
| | | L | P | |
| CA 501 | Computer Fundamentals and Programming | 3 | 1 | Pal Singh, SN Islam |
| CA 562 | Object Oriented Analysis and Design | 2 | 1 | Sudeep |
| CA 564 | Data Structures and Algorithms | 2 | 1 | Shashi Dahiya, AR Rao |
| CA 566/ BI 506 | Database Management System | 2 | 2 | OP Khanduri, SB Lal |
| CA 572 | GIS and Remote Sensing Techniques | 2 | 1 | Prachi Misra Sahoo, Anshu Bharadwaj |
| CA 577 | Data Mining and Soft Computing | 2 | 1 | Alka Arora, Anshu Bharadwaj |
| CA 612 | Fuzzy Sets and Rough Sets | 2 | 1 | Alka Arora, Rajni Jain |
| CA 578 | Information Security | 2 | 1 | Sudeep, Yogesh Gautam |
| CA 691 | Seminar | 1 | 1 | Pal Singh |

## Courses taught during the Academic Year 2012-13 in Bioinformatics

| Trimester - III | | | | |
|---|---|---|---|---|
| Code | Course Title | Credits | | Instructor |
| | | L | P | |
| BI 510 | Biological Databases and Data Analysis | 2 | 1 | Sanjeev Kumar, Samir Farooqi, SB Lal, MN Varah Parsad |
| BI 511 | RNA/Protein Structure Predication and Molecular Modeling | 1 | 2 | Sarika, Anil Rai, SS Marla |
| BI 512 / AS 608 | Advanced Bioinformatics | 2 | 1 | AR Rao, M Grover, DC Mishra |
| BI 691 | Seminar | 1 | 0 | Sudhir Srivastava |

**Courses taught during the Academic Year 2013-14 in Bioinformatics**

| Code | Course Title | Credits | | Instructor |
|------|-------------|---------|---|-----------|
| | | **Trimester - I** | | |
| | | L | P | |
| BI 501/ MBB 502 | Fundamentals of Molecular Biology | 3 | 0 | Pradeep Kumar Jain, Sharmistha Barthakur, Subodh Kumar Sinha, Pranav Kumar Mandal |
| BI 502/ CA 502 | Introduction to Computer Application | 1 | 1 | Samir Farooqi, SN Islam |
| BI 503/ CA 551 | Mathematical Foundations in Computer Application | 4 | 0 | NK Sharma, Sukanta Dash |
| BI 504/ MBB 501 | Principles of Biotechnology | 3 | 0 | Ram Charan Bhattacharya, Debasis Pattanayak, Amol Kumar Solanke |
| BI 505/ CA 561 | Principles of Computer Programming | 2 | 1 | SB Lal, KK Chaturvedi |
| BI 523 | Advanced Techniques for Sequence and Structure Analysis | 1 | 2 | Anil Rai, Sunil Archak |
| BI 524 | Tools and Techniques for Biological Data Mining | 2 | 1 | Sanjeev Kumar, Mir Asif Iquebal |
| BI 525 | Advanced Programming in Bioinformatics | 2 | 1 | SB Lal, Anu Sharma |
| BI 691 | Seminar | 1 | 0 | Sarika |

| Code | Course Title | Credits | | Instructor |
|------|-------------|---------|---|-----------|
| | | **Trimester - II** | | |
| | | L | P | |
| BI 506/ CA 566 | Database Management System | 2 | 2 | OP Khanduri, SB Lal |
| BI 507/ GP 540/ MBB 509 /AS 571 | Bioinformatics-I | 3 | 1 | TR Sharma, AR Rao, Rajender Parsad, Sunil Archak |
| BI 508/ BIO 602 | Protein Biosynthesis | 3 | 0 | Archana Sachdeva |
| BI 509/ MBB 602 | Genomics | 3 | 0 | Nagendra Kumar Singh |
| BI 528 | Chemoinformatics and IPR Issues | 1 | 1 | DC Mishra, Sudhir Srivastava |
| BI 691 | Seminar | 1 | 0 | DC Mishra |

## Board of Studies for Academic Year 2013-14

### Agricultural Statistics

| | | |
|---|---|---|
| 1. | Dr. Rajender Parsad, Professor (Agricultural Statistics) | Chairman |
| 2. | Dr. UC Sud, Director (A) | Member (Ex-officio) |
| 3. | Dr. KK Tyagi, Principal Scientist | Member |
| 4. | Dr. Prawin Arya, Senior Scientist | Member |
| 5. | Dr. Ranjit Kumar Paul, Scientist | Member Secretary |
| 6. | Sh. Kader Ali Sarkar, Student | Students' Representative |

### Computer Application

| | | |
|---|---|---|
| 1. | Dr. PK Malhotra, Professor (Computer Applications) | Chairman |
| 2. | Dr. UC Sud, Director (A) | Member |
| 3. | Dr. Sudeep, Senior Scientist | Member |
| 4. | Dr. Yogesh Gautam, Scientist | Member |
| 5. | Dr. Sangeeta Ahuja, Scientist | Member |
| 6. | Sh. Pal Singh, Scientist | Member Secretary |
| 7. | Ms. Sanchita Neha, Student | Students' Representative |

**Bioinformatics**

| | | |
|---|---|---|
| 1. | Dr. Anil Rai, Professor (Bioinformatics) | Chairman |
| 2. | Dr. UC Sud, Director (A) | Member |
| 3. | Dr. KV Bhatt, Principal Scientist | Member |
| 4. | Dr. T Napolean, Senior Scientist | Member |
| 5. | Sh. SB Lal, Scientist | Member |
| 6. | Dr. Sunil Archak, Scientist | Member |
| 7. | Dr. DC Misra, Scientist | Member Secretary |
| 8. | Ms. Sayanti Guha Majumdar, Student | Students' Representative |

## Central Examination Committee for Academic Year 2013-15

**Agricultural Statistics**

1. Dr. UC Sud, Director (A)
2. Dr Rajender Parsad, Head & Professor (Agricultural Statistics)
3. Dr. KK Tyagi, Principal Scientist
4. Dr. LM Bhar, Principal Scientist
5. Dr. AR Rao, Principal Scientist
6. Dr. Himadri Ghosh, Principal Scientist

**Computer Application**

1. Dr. UC Sud, Director (A)
2. Dr. PK Malhotra, Professor (Computer Applications)
3. Dr. Seema Jaggi, Principal Scientist
4. Dr. Sudeep, Senior Scientist
5. Dr. Alka Arora, Senior Scientist
6. Dr. Rajini Jain, Principal Scientist
7. Ms. Shashi Dahiya, Scientist

**Bioinformatics**

1. Dr. UC Sud, Director (A)
2. Dr. Anil Rai, Professor (Bioinformatics)
3. Dr. AR Rao, Principal Scientist
4. Dr. T Napolean, Senior Scientist
5. Dr. Sunil Archak, Senior Scientist

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

## From Director's Desk . . .

This newsletter highlights some of the salient research and training achievements made and other significant activities performed during the period under report.

The first supercomputing hub for Indian Agriculture ASHOKA (Advanced Super-computing Hub for OMICS Knowledge in Agriculture) established at Centre for Agricultural Bioinformatics (CABin), Indian Agricultural Statistics Research Institute, was dedicated to the Nation by Shri Sharad Pawar, Honourable Union Minster of Agriculture and Food Processing Industries in presence of Dr. Charan Das Mahant, Shri Tariq Anwar, Union Minsters of State for Agriculture and Food Processing Industries and Dr. S Ayyappan, Secretary DARE and D.G. ICAR on 15 January 2014.

ICAR-ERP (Enterprise Resource Planning) system which includes solution for financial project, human resource, material and payroll management has been implemented in IASRI, IARI, NAARM, CIFE, NDRI from 1st February 2014 and ICAR HQ and IVRI w.e.f. 26 February 2014. System has been implemented in CPRI, CRRI, NBSS&LUP, CAZRI, CIAE, CSWCRTI, IGFRI, CRIDA, IIHR, CMFRI and NBPGR from April 2014. ICAR-ERP is hosted on IASRI website and can be accessed through URL: http://icarerp.iasri.res.in and it can also be visited through http://www.iasri.res.in/mis/fms/

Indian NARS Statistical Computing Portal (http://stat.iasri.res.in/sscnarsportal) has been strengthened by adding the modules of Cross over designs and Estimation of genetic variance-covariance from block designs. With these 2 new additions, now 24 analysis modules are available on this portal which have been classified into four broad categories as: Basic Statistics, Design of Experiments, Multivariate Analysis and Statistical Genetics.

Calibration estimators of finite population total for two stage sampling design have been proposed and through empirical evaluation it was found that the proposed estimators were performing better than the usual Horvitz Thompson estimator under two-stage sampling design. Through limited empirical evaluation it was found that all the higher order calibration estimators were also efficient.

A general method of constructing row-column design with two rows has been developed for orthogonal estimation of main effects and two factor interaction in minimum number of runs for orthogonal parameterization.

One Statistics Module of the Subject Matter Training for Scientists from Islamic Republic of Afghanistan and one Modular Course on Statistical Methods for Agricultural Research for the participants of an International M.Sc. Programme for Afghan Nationals on Teaching of Post-Graduate courses in Agronomy were organised. Two Refresher Training Programmes on Integrated Sample Survey Methodology sponsored by Ministry of Agriculture, Govt. of India and one training programme on Computational and Statistical Advances in Biometrics for 'omics' Data, under CAFT sponsored by Education Division, ICAR were organised. Three training programmes sponsored by NAIP, one each on Data Analysis using SAS, under SSC-NARS; Computational Aspect for NGS Data Analysis: a sojourn from lab to field at Ome Research facility under NABG and Advanced Analytical Techniques in Bioinformatics under Bioprospecting of genes and allele mining for abiotic stress tolerance were also organised. Apart from these one training workshop on Computer Assisted Text Analysis under "Mapping the Cultural Authority of Science across Europe and India (MACAS-EU & INDIA)" project sponsored by Indian Council of Social Science Research (ICSSR), one workshop cum Koha Professional Training under "Strengthening of Digital Library and Information Management" sponsored by NAIP and one Sensitization Workshop on Internet Protocol Ver. 6 (IPv6) were also organised.

Scientists of the institute have received various awards & recognitions. Scientists have visited various countries on different assignments. During the period two new projects were initiated. Scientists of the Institute have published 17 research papers, 07 leaflets/brochures, 02 popular articles, 01 book chapter and 01 reference manual. Besides this, 28 research papers were presented in different conferences/symposial workshops, etc.

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.

(UC Sud)

# IASRI ANNUAL REPORT

## 2012-13

अंक 9

कृषि अनुसंधान
डाटा पुस्तिका
## AGRICULTURAL RESEARCH DATA BOOK 2013

सांख्यिकी-विमर्श

2013-14

# 5

# Awards and Recognitions

**AWARDS**

**Lal Bahadur Shastri Outstanding Young Scientist Award**

- Dr. Hukum Chandra received Lal Bahadur Shastri Outstanding Young Scientist Award-2012 of ICAR on 16 July 2013 for his outstanding contribution in the field of Social Sciences.



**Fellow Award**

- Dr. Dinesh Kumar received Fellow Award 2012 by Society of Applied Biotechnology in recognition of outstanding achievements and contributions to the field of Bioinformatics.

**IARI Merit Medal**

- Dr. Arpan Bhowmik received IARI Merit Medal for Ph.D. Research during the 52nd Convocation of PG School IARI on 21 February 2014.



**Team Award**

- Dr. Anil Rai received Team Award from Indian Society of Agricultural Engineering for significant contribution in the project "Assessment of Harvest and Post-Harvest Losses of Major Crops and Livestock Produce in India" on February 22, 2014 along with Dr. SK Nanda, Ex-Project Coordinator (AICRP on Post Harvest Technology), CIPHET, Ludhiana, Dr. RK Vishwakarma, Senior Scientist, CIPHET, Ludhiana, Dr. HVL Bathla, Head (Rtd), Division of Sample Survey, IASRI, New Delhi, Prof. VK Sehgal, Senior Research Engineer (Rtd), PAU, Ludhiana and Sectoral PI (Food Grains) under AICRP on PHT, Dr. PC Sharma, Head, Horticultural Crops Processing, CIPHET, Abohar and Sectoral PI (Horticultural Crops) under AICRP on PHT, Dr. Robinson JJ Abraham, Head, Department of Meat Science & Technology, TANUVAS, Chennai and

Sectoral PI (Livestock Produce) under AICRP on PHT, Dr. Pitam Chandra, Director, CIAE, Bhopal and Ex-ADG (Process Engg).

- Scientists of the Institute received the following Awards during 67th Annual Conference of the Indian Society of Agricultural Statistics held during December 18-20, 2013 at Department of Farm Engineering, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi - 221 005 (UP).

  - Dr. Rajender Parsad, Head, Division of Design of Experiments, IASRI, New Delhi was awarded ISAS Fellow.



  - Dr. Bishal Gurung, Scientist, IASRI, New Delhi, received Dr. GR Seth Memorial Young Scientist Award (2013) for the following paper:
    Gurung, Bishal, Paul, Ranjit Kumar and Ghosh, Himadri. Fitting Smooth Transition autoregressive nonlinear time-series model using particle swarm optimization technique.

### Poster Awards

- Singh, Ravindran, Katiyar, Vijay Kumar, Islam, SN, Singh, Randhir and Verma RPS. Expert system on barley crop management. Received the Best Poster Award in the International Conference on Impact of Technological Tools on Food Security under Global Warming Scenario (ITTFS 2012) at Shobhit University, Modipuram during 11 -12 May, 2013.

- Dubey, PP and Kumar, Dinesh. Genomic selection in livestock and poultry. Received Second Best Poster Award in the National Conference on Emerging Problems and Recent Advances in Applied Sciences: Basic to Molecular Approaches organised by Society for Scientific Development

in Agriculture and Technology, Meerut (UP) in Collaboration with Deptt of Horticulture & Biotechnology, Ch. Charan Singh University, Meerut-250004 and Society for Extension Education and Management in Agriculture, Jhansi (UP) during 08-09 February 2014.

### Awards During Hindi Pakhwara

- Following papers were awarded in the Hindi Research Paper Poster Presentation organized at IASRI on September 10, 2013 during Hindi Pakhwada celebration from 01-16, September 2013:

  - अर्पण भौमिक, एल्दो वर्गीस, सीमा जग्गी, सिनी वर्गीस एवं बी. जे. गहलौत। निकटवर्ती इकाइयों के प्रभावों को सम्मिलित करते हुए कृषि परीक्षणों के लिए सन्तुलित अभिकल्पनाओं का निर्माण। (प्रथम)

  - सारिका, इकबाल, मौ. आसिफ, राय, अनिल एवं कुमार, दिनेश। कृत्रिम न्यूरल नेटवर्क कार्यप्रणाली आधारित डी.एन.ए. माइक्रोसैटेलाइट मार्कर द्वारा नस्ल पहचान विधि। (द्वितीय)

  - सुदीप, सिंह, पाल, गौतम, योगेश, यादव, वी.के. एवं मौर्या, एम.एम.। मक्का फसल के लिए दक्ष तंत्र। (तृतीय)

- Division of Design of Experiments was awarded the Shield for maximum scientific work done in Hindi in the year 2012-13 during the Hindi Pakhwara.

### RECOGNITIONS

### Dr. UC Sud

- Member, 19th meeting of statistical methods for quality and reliability sectional Committee, MSDC held on 08 April, 2013 at Bureau of Indian Standards, Manak Bhawan, New Delhi.

- Member, First meeting of the Committee to examine methodological issues relating to fixing Minimum Support Prices (MSPs) on 09 May 2013 at Acharya Jagdish Chandra Bose Hall, Krishi Bhawan, New Delhi.

- Member, 17th meeting of Management and Systems Division Council (MSDC) on 10 May 2013 at Bureau of Indian Standards, Manak Bhawan, New Delhi.

- Member, Cost of cultivation survey meeting on 20 May 2013, Directorate of Economics & Statistics, Jaipur.

- Chairman, 2nd Sub Committee of the Kerala State Strategic Statistical Plan (KSSSP) Implemetnation Expert Committee (Agricultural Statistics) at Thiruvanthapuram on 19 June 2013.

- Member, Meeting of the Committee for updation of the rates and ratios used in the compilation of estimates of domestic product, capital formation and other aggregates of NAS at Sardar Patel Bhawan, New Delhi on 28 June 2013.

- Vice-Chairman, Technical Committee of Direction for Improvement of Animal Husbandry and Dairying Statistics (TCD) for the year 2013 during 04-05 July 2013 at Guru Nanak Dev University, Amritsar.

- Member, Meeting on Quinquennial Livestock Census Integrated Sample Survey Scheme on 02 August 2013 at Krishi Bhawan, New Delhi.

- Member, Second meeting of the Committee to examine methodology issues in fixing minimum support prices on 07 August 2013.

- Member, First meeting of the Standing Committee for the 21st Conference of Central and State Statistical Organizations (COCSSO) on 13 August 2013.

- Chairman, 11th meeting of the Technical Monitoring Committee for Central Sector Scheme on "Strenghtening of Database and Geographical Information System for the Fisheries Sector" on 30 August 2013.

- Member, Empowered Committee meeting for Implementation of the Scheme "Awards & Fellowships and Outstanding and Meritorious Research Studies in Statistics' on 10 October 2013 at Sardar Patel Bhawan, New Delhi.

- Member, Meeting on Recruitment of Consultants (Statistics) on Contractual Basis on 28 October 2013 at Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture.

- Member, Meeting of Constitution of Technical Committee to examine the method of sampling of imported fertilizer on 29 October 2013 at Krishi Bhawan.

- Member, Third meeting of the committee to examine methodological issues in fixing minimum support prices on 12 November 2013 at Krishi Bhawan.

- Member, Meeting of the Committee for examining the proposals of Type Studies on 06 December 2013 at Sardar Patel Bhawan, New Delhi.

- Member, Second meeting of the Technical Committee on Sampling & Methods of Analysis of Imported Fertilisers held on 21 January 2014 at KAB-II, New Delhi under the Chairmanship of Dr AK Sikka, DDG (NRM).

**Dr. VK Gupta**

- Chairman, Organizing Committee for 16th Annual Conference of the Society of Statistics, Computer and Applications held at BPSMV, Khanpur Kalan, Sonepat (February 24-26, 2014).

- Chaired one of the Plenary talks on 24th February 2014 on 'Calibration Estimation in Survey Sampling' during 16th Annual Conference of the Society of Statistics, Computer and Applications held at BPSMV, Khanpur Kalan, Sonepat during February 24-26, 2014.

**Dr. Anil Rai**

- Nominated by the Council as member of RAC of National Institute of Veterinary Epidemiology and Disease Informatics, Bangalore.

- Invited as an expert in IRC of Unit of Simulation and Informatics, IARI, New Delhi on April 29, 2013.

- Invited as expert on June 4, 2013 for selection of Faculty i.e. Assistant Professor, Associate Professor and Professor at Central University Punjab, Bhatinda, Punjab.

- Delivered Key Note Address on National Agricultural Bioinformatics Grid in Workshop-cum Training on Computational Techniques for Biological Data Mining at USI, IARI, New Delhi on 24 March 2014.

**Dr. Rajender Parsad**

- Invited as an Expert in Brainstorming Session on Experimental Designs for Coordinated Wheat and Barley Trials held at DWR, Karnal on January 16, 2014.

- Plenary Speaker and Chairman of a Session of Special Invited Lectures during XVI Annual

Conference of Society of Statistics, Computer and Applications held at Bhagat Phool Singh Mahila Vishwavidyalya, Khanpur Kalan, Sonepat during February 24-26, 2014.

- Chaired a session of Invited talks and invited Panelist in the session on Applications of Statistics during International Conference on Statistics 2013: Socio-economics and Sustainable Challenges & Solutions organized at CR Rao Advanced Institute of Mathematics, Statistics and Computer Sciences, Hyderabad during December 28-31, 2013.

- Chaired a session on Automation of AICSIP Trials organized during 43rd Annual Group Meeting of All India Coordinated Sorghum Improvement Project held at DSR, Hyderabad on 21 April 2013.

## Dr. Hukum Chandra

- Convener of an invited plenary session on "Small Area Inference from Agricultural Survey Data" in the First Asian International Statistical Institute Satellite Conference on Small Area Estimation, during 01-04 September 2013 at Bangkok, Thailand.

- International Consultant Sampling for the FAO of the United Nation in Ethiopia during July 27-August 17, 2013.

- Member, Scientific Committee, The First Asian International Statistical Institute Satellite Conference on Small Area Estimation, 2013, Bangkok, Thailand, September 01-04, 2013.

- Convener of a session on "Survey Sampling for Policy Planning", during the 16th Annual Conference of the Society of Statistics, Computer and Applications held at Bhagat Phool Singh Mahila Vishwavidyala, Sonepat, during February 24-26, 2014.

- Chaired an invited session on "Applied Mathematics and Forest Biometrics", in the National Seminar on Applied Statistics and its Application in Forestry, TFRI, Jabalpur, Madhya Pradesh, April 15-17, 2013.

- Chaired a session on "Empirical Best Prediction Methods in Small Area Estimation" in The First Asian International Statistical Institute Satellite Conference on Small Area Estimation, 2013, Bangkok, Thailand during September 01-04, 2013.

## Dr. AR Rao

- Presided as an Expert in the function Statistics Day on 29 June 2013 at Indira Gandhi Krishi Vishwavidyalaya, Raipur and addressed the audience on Statistics for Agricultural Development.

## Dr. Dinesh Kumar

- Invited speaker in Brain Storming Session on "Bioresources and Sustainable Development in North East" during 11-12 November 2013 at Institute of Bioresources & Sustainable Development (DBT, Govt of India), Imphal, Manipur.

- Invited speaker in Indo UK Scientific Seminar on "Structural elucidation of microbial natural products: Opportunities and challenges sponsored by Royal Society of London and DST (Govt. of India) organized at School of Biotechnology, Mizoram Central University, Aizawl during 15-17 January 2014.

- Invited as Bioinformatics Subject Expert for review of ongoing research projects and interview of Scientist assessment of DBT (Govt of India) Institute, IBSD, Imphal, Manipur on 01 February 2014.

## Dr. LM Bhar

- Convener of a Session of invited talks on "Some Considerations in Experimental Designs and their Applications" during XVI Annual Conference of Society of Statistics, Computer and Applications held at Bhagat Phool Singh Mahila Vishwavidyalya, Khanpur Kalan, Sonepat during February 24-26, 2014.

## Dr. Tauqueer Ahmad

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

## Dr. Sudeep

- Received Appreciation Letter from Dean, PG School, IARI, New Delhi for Best Teacher in the discipline of Computer Application.

**Sh. SN Islam**

- The project "Expert System on Seed Spices" has been acknowledged by the grand jury of "Digital Empowerment Foundation" and has been given a certificate of recognition.

**Sh. Samir Farooqi**

- Convener of the session on Informatics in Agricultural Research during the 67th Annual Conference of ISAS from 19-20 December 2013 at BHU, Varanasi.

**Dr. Ranjit Kumar Paul**

- Rapporteur in the Technical Session on "Agricultural Growth and Natural Resource" in the 21st Annual Conference of Agricultural Economics Research Association held in SKUAST-Kashmir, Srinagar during September 10-12, 2013.

**Dr. Susheel Kumar Sarkar**

- Convener of a Session of invited talks on "Some Considerations in Experimental Designs and their Applications" during XVI Annual Conference of Society of Statistics, Computer and Applications held at Bhagat Phool Singh Mahila Vishwavidyalya, Khanpur Kalan, Sonepat during February 24-26, 2014.

**Offices in Professional Societies/Research Journals**

**Agricultural Research**

| | |
|---|---|
| Dr. VK Gupta | Associate Editor |

**Annals of Agricultural Research**

| | |
|---|---|
| Sh. SN Islam | Member, Editorial Board |

**Bureau of Indian Standards, New Delhi**

| | |
|---|---|
| Dr. Rajender Parsad | Member, Management and Systems Division Council |

**Computer Society of India, Delhi Chapter**

| | |
|---|---|
| Dr. Alka Arora | Member, Management Committee |

**Current Trends in Technology & Sciences**

| | |
|---|---|
| Sh. KK Chaturvedi | Member Editorial Board |

**Hindi Academy, Delhi**

| | |
|---|---|
| Dr. Ranjana Agrawal | Member, Governing Body (till 31.07.2013) |

**Indian Society of Agricultural Statistics**

| | |
|---|---|
| Dr. VK Gupta | Vice President<br>Chair Editor, JISAS |
| Dr. UC Sud | Honorary Secretary (w.e.f. 01.01.2014)<br>Member, Executive Council (till 31.12.2013)<br>Associate Editor, JISAS |
| Dr. Rajender Parsad | Joint Secretary (till 31.12.2013)<br>Coordinating Editor, JISAS |
| Dr. PK Malhotra | Joint Secretary (till 31.12.2013)<br>Coordinating Editor, JISAS |
| Dr. Hukum Chandra | Joint Secretary (w.e.f. 01.01.2014)<br>Member, Executive Council (till 31.12.2013) |
| Dr. Lal Mohan Bhar | Joint Secretary (w.e.f. 01.01.2014) |
| Dr. Prajneshu | Associate Editor, JISAS (till 31.07.2013) |
| 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 |

**Indian Society of Pulses Research and Development**

| | |
|---|---|
| Dr. MA Iquebal | Editor |

**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 |
| Dr. Prajneshu | 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 Emerging Technology and Advanced Engineering**

| | |
|---|---|
| Sh. KK Chaturvedi | 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**

| | |
|---|---|
| Md. Samir Farooqi | Member, Editorial Board |

**Journal of Statistical Theory and Practice**

| | |
|---|---|
| Dr. VK Gupta | Associate Editor |
| Dr. Prajneshu | Associate Editor |

**Journal of Model Assisted Statistics and Applications**

| | |
|---|---|
| Dr. Hukum Chandra | Associate Editor |
| Dr. Eldho Varghese | Associate Editor |

**Medicinal and Aromatic Plants Association of India**

| | |
|---|---|
| Dr. N Srinivasa Rao | Vice President |

**Ministry of Statistics & Programme Implementation**

| | |
|---|---|
| Dr. UC Sud | Member, Empowered Committee for Awards and Fellowship for Outstanding and Meritorious Research Work in Statistics |
| Dr. VK Gupta | Member, Screening Committee for Awards and Fellowship for Outstanding and Meritorious Research Work in Statistics |

**Pusa AgriScience, Journal of IARI, PG School**

| | |
|---|---|
| Dr. Rajender Parsad | Member, Editorial Board |

**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 | Executive Editor, Statistics and Applications |
| Dr. LM Bhar | Joint Secretary Managing Editor, Statistics and Applications |
| Dr. Seema Jaggi | Member, Executive Council |
| Dr. Alka Arora | Member, Executive Council |
| Dr. Hukum Chandra | Associate Editor, Statistics and Applications |

**Swadeshi Science Movement of Delhi**

| | |
|---|---|
| Dr. Sushila Kaul | Member, Executive Council |

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**Copyrights Received**

| Sr. No. | Name of Technology (Software)/ Literary Work | Author(s) | Copyright Registration Number | Date on which Copyright Granted |
|---|---|---|---|---|
| 1. | Design Resources Server | • Rajender Parsad<br>• VK Gupta | L-46452/2013 | 07/06/2013 |
| 2. | Monograph on Hadamard Matrices | • VK Gupta<br>• A Dhandapani<br>• Rajender Parsad | L-51175/2013 | 04/07/2013 |
| 3. | Monograph on α-designs | • Rajender Parsad<br>• VK Gupta<br>• PK Batra<br>• SK Satpati<br>• Pabitra Biswas | L-51734/2013 | 24/07/2013 |
| 4. | Indian NARS Statistical Computing Portal (Software) | • Rajender Parsad<br>• A Dhandapani | SW-7397/2013 | 25/10/2013 |
| 5. | Knowledge Data Warehouse for Agricultural Research (KWAR) | • Anil Rai<br>• PK Malhotra<br>• Seema Jaggi<br>• Krishna Kumar Chaturvedi<br>• Prachi Misra Sahoo<br>• Samir Farooqui | SW-7396/2013 | 25/10/2013 |
| 6. | Indian NARS Statistical Computing Portal (Manual) | • Rajender Parsad<br>• A Dhandapani | L-55719/2013 | 25/10/2013 |
| 7. | shRNA Pred (Version1.0) | • Nishtha Singh<br>• Tanmaya Kumar Sahu<br>• Atmakuri Ramakrishna Rao<br>• Trilochan Mohapatra | SW-7548/2013 | 09/12/2013 |
| 8. | Expert System for Maize Crop (MaizeAGRIdaksh) | • Hari Om Agarwal<br>• Sudeep Marwaha<br>• Harnam Singh Sikarwar<br>• Pal Singh<br>• Virendra Kumar Yadav<br>• Sain Dass<br>• Jyoti Kaul<br>• Sangit Kumar<br>• P Kumar<br>• ML Jat<br>• KP Singh<br>• CM Parihar | SW-7566/2013 | 17/12/2013 |
| 9. | Web based Software for Survey Data Analysis (SSDA 2.0) | • SB Lal<br>• Anu Sharma<br>• Hukum Chandra<br>• Anil Rai | SW-7576/2013 | 23/12/2013 |

# ICAR ERP

## Implementation of MIS & FMS in ICAR

## Information System on Designed Experiments (ISDE)

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agresearch with a Human touch

Designed Experiments Information System provides information on various types of experiments conducted over length and breadth covering different **agro-climatic zones** of India. This Information system aims at systematic maintenance of data of designed experiments, along with ancillary information, conducted in National Agricultural Research System - NARS on various aspects, at a central place and retrieval of information on selective basis as per requirements. Agencies engaged in Agricultural Research in India are Agricultural Universities, ICAR's Research Institutes, Project Directorates, All India Co-ordinates Research Projects, and Directorates of Agriculture of State Governments etc. The technical officers of the Institute especially engaged for collecting data have so far been collecting data of agricultural field experiments except varietal trials conducted at various Agricultural Research Stations of these organizations. Attempts would be made for active participation of scientists of various organizations to share their data and enrich the database by on-line data entry of their respective experimental information from their location. The database is to be updated regularly so that it could answer user-based queries in respect of one or more of the data items as also give many customized reports based on most commonly used pre-defined queries. It is proposed to include experiments on cropping sequence, intercropping, on-farm trials as well as other disciplines - where designed experiments are used for experimentation - in the database. Studies relating to the inclusion of on-line data analysis shall also be attempted.

In agriculture and natural resources research and development, the role of research managers is as crucial as the role and value of information. With the management's task of decision-making and problem-solving, their quality and effectiveness are affected by the **accuracy, sufficiency,** and **timeliness** of information. And since problems in any field - including agriculture - are best understood as one of the basic endeavor of information processing, an appropriate availability of information through some information system is desirable.

**AFEIS**

**Information System on PDFSR Experiments**

**On-Farm**

**On-Station**

**ISLTFE**

**Related Links**

**IASRI**

**ICAR**

## SAMPLE SURVEY RESOURCES SERVER

| Home | E-Learning | Ask A Question | Archive Of Questions | Discussion Board | Software | FAQ's | Contact Us |

2014/06/21 Sat 04:06:08 PM

**Best viewed in Google Chrome and Mozilla Firefox Web Browser.**

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

Search SSRS site...

**SAMPLE SIZE CALCULATORS**

Determination of Sample Size for Estimation of Population Mean

click here

# 6

## 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. | Livelihood and nutritional security of tribal dominated areas through integrated farming system and technology models | MPUA&T, Udaipur IARI, New Delhi (NAIP Component-III) | 11 October 2007 (IASRI association w.e.f. 01 August 2011) | 31 March 2014 |
| 3. | E-publishing and knowledge system in agricultural research | DKMA (NAIP Component-I) | 01 November 2008 (IASRI association w.e.f. 11 September 2013) | 31 March 2014 |
| 4. | Strengthening statistical computing for NARS | NDRI, Karnal; IVRI, Izatnagar; MPUAT,Udaipur; DWM, Bhubaneshwar; ICAR RC NEHR,  Barapani; UAS, Bengaluru; NAARM, Hyderabad; CIFE,  Mumbai (NAIP Component-I) | 20 April 2009 | 31 March 2014 |
| 5. | Bioprospecting of genes and allele mining for abiotic stress tolerance | NRCPB, New Delhi (NAIP Component-IV) | 04 May 2009 | 31 May 2014 |
| 6. | Genomics and molecular markers in crop plants (Sub-project 4: Development of new genomic and EST resources and functional genomics of thermo tolerance in mandate crops) | NRCPB, New Delhi | 01 April 2009 | 31 March 2014 |
| 7. | Farm power machinery use protocol and  management for sustainable crop production | IARI, New Delhi | 01 April 2009 | 31 March 2014 |

| S.No. | Title | Collaborative/ Funding Agency | Date of Start | Date of Completion |
|---|---|---|---|---|
| 8. | Weed assessment and management in the crops and cropping system | IARI, New Delhi | 01 April 2009 (IASRI association w.e.f. 29 December 2010) | 31 March 2014 |
| 9. | Development of innovative convenience food as protein supplement | IARI, New Delhi | 01 April 2009 (IASRI association w.e.f. 24 October 2009) | 31 March 2014 |
| 10. | Weather based forewarning of mango pests | CISH, Lucknow; RFRS, Vengurle; BCKV, Mohanpur; BAC, Sabour; FRS, Sangareddy | 01 April 2010 | 31 July 2013 |
| 11. | Establishment of national agricultural bioinformatics grid for ICAR | NBPGR, New Delhi NBAGR, Karnal NBFGR, Lucknow NBAIM, Maunath Bhanjan NBAII, Bangalore (NAIP Component-I) | 01 April 2010 | 30 June 2014 |
| 12. | Refinement of livestock feed resources and development of dynamic database information system | NIANP, Bangaluru | 01 July 2010 | 31 December 2014 |
| 13. | Phenomics of moisture deficit and low temperature stress tolerance in rice | NRCPB, New Delhi IARI, New Delhi Delhi University, New Delhi CRRI, Cuttack; IGKV, Raipur CAU, Barapani ICAR RC-NEHR, Barapani | 15 February 2011 | 14 February 2016 |
| 14. | Development of web based mushroom expert system | DMR, Solan | 01 April 2011 | 31 March 2015 |
| 15. | Strengthening and refinement of Maize AgriDaksh | DMR, New Delhi | 01 April 2011 | 31 March 2016 |
| 16. | Pest and diseases dynamic vis-a-vis climatic change under the project National Initiative on Climate Resilient in Agriculture (NICRA) | NCIPM, New Delhi (NICRA) | 01 June 2011 | 31 March 2017 |
| 17. | Study of synonymous codon usage and its relation with gene expressivity in genomes of halophilic bacteria | NBAIM, Mau | 01 August 2011 | 15 April 2013 |
| 18. | Development of forecasting methodology for fish production from ponds of upland region | DCFR, Bhimtal | 20 August 2011 | 30 August 2013 |
| 19. | Enhancing resilience of agriculture to climate change through technologies, institutions and policies | NCAP, New Delhi (NICRA) | 29 August 2011 | 26 August 2014 |

| S.No. | Title | Collaborative/ Funding Agency | Date of Start | Date of Completion |
|---|---|---|---|---|
| 20. | ePlatform for seed spice growers | NRCSS, Ajmer | 17 December 2011 | 15 November 2013 |
| 21. | In silico identification of abiotic stress (salinity) responsive transcription factors and their cis-regulatory elements in grapes | NRC Grapes, Pune | 01 January 2012 | 31 December 2013 |
| 22. | Assessment of quantitative harvest and post harvest losses of major crops/ commodities in India | CIPHET, Ludhiana | 01 February 2012 (IASRI association w.e.f. 01 June 2012) | 31 January 2015 |
| 23. | Buffalo genome information resource | NDRI, Karnal (DST) | 26 March 2012 | 25 March 2014 |
| 24. | Planning, designing and analysis of experiments planned ON-STATION under PDFSR | PDFSR, Modipuram | 01 April 2012 | 31 March 2014 |
| 25. | Planning, designing and analysis of ON-FARM experiments under PDFSR | PDFSR, Modipuram | 01 April 2012 | 31 March 2014 |
| 26. | Planning, designing and analysis of data relating to experiments conducted under AICRP on LTFE | AICRP on LTFE IISS, Bhopal | 01 April 2012 | 31 March 2014 |
| 27. | Bioacoustics tool: A novel non-invasive approach for different monitoring of health and productivity in dairy animals | NDRI, Karnal (DBT) | 01 February 2013 | 31 January 2016 |
| 28. | Information system for planning and analysis of experiments on All-India Coordinated Research Project on Vegetable Crops | AICRP, IIVR, Varanasi NAARM, Hyderabad | 05 February 2013 | 28 February 2015 |
| 29. | Engaging farmers, enriching knowledge: agropedia phase-II | IIT, Kanpur (NAIP) | 01 April 2013 | 30 June 2014 |
| 30. | Modelling network of gene responses to abiotic stress in rice | NRCB, New Delhi, DRR, Hyderabad, DKMA, New Delhi, CDAC, Pune (NFBSFARA) | 01 April 2013 | 31 March 2016 |
| 31. | National information system for pest management (BT Cotton) | NCIPM (Ministry of Agriculture, Government of India) | 08 July 2013 | 31 March 2014 |
| 32. | Whole genome sequencing and development of allied genomic research in two commercially important Fish-Labeo rohita and Clarias batrachus | NBFGR, CIFA, AAU (DBT) | 10 September 2013 | 09 September 2016 |
| 33. | Development of innovative approaches for small area estimation of crop yield, socio-economic and food insecurity parameters | ICAR, Lal Bahadur Shashtri Young Scientist Award | 09 December 2013 | 08 December 2016 |
| 34. | Network project on market intelligence | NCAP, New Delhi (ICAR, DARE) | 13 February 2014 | 31 March 2017 |

| | | Government of India | | |
|---|---|---|---|---|
| S.No. | Title | Collaborative/ Funding Agency | Date of Start | Date of Completion |
| 35. | Whole genome association (WGA) analysis in common complex diseases: An Indian initiative | UDSC, NII, Delhi University, AIIMS, DMC (DBT) | 29 September 2008 | 28 July 2014 |
| 36. | Experimental designs in the presence of indirect effects of treatments | DST | 01 October 2011 | 30 September 2014 |
| 37. | Assesment of quantitative harvest and post harvest losses of major crops/ commodities in India | CIPHET, Ludhiana (Ministry of Food Processing Industries, Government of India) | 01 February 2012 (IASRI association w.e.f. 01 June 2012) | 31 January 2015 |
| 38. | A new distributed computing framework for data mining | BITS, Pilani (Departmrnt of Electronics & Information Technology, Government of India) | 15 October 2012 (IASRI association w.e.f. 01 November 2012) | 14 October 2015 |
| 39. | 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 |
| 40. | Whole genome sequencing and development of allied genomics resources in two commercialy important Fish-Labeo rohita and clarias batrachus | NBFGR, CIFA, AAU (DBT) | 28 January 2014 | 09 September 2016 |
| | | Consultancy Studies | | |
| 41. | Study to develop an alternative methodology for estimation of Cotton production | Directorate of Economics and Statistics (DES), Ministry of Agriculture | 01 April 2011 | 31 July 2013 |
| 42. | Impact assessment of agroforestry model in Vaishali district of Bihar State | IFP (ICFRE), Ranchi | 10 September 2012 | 09 May 2013 |

# 7

# List of Publications

**Research Papers**

1. Aditya, K, Sud, UC and Chandra, H (2012). Estimation of domain total for unknown domain size in the presence of nonresponse. *Statist. Appln.*, **10(1-2)**, New Series, 13-25.

2. Aditya, K, Sud, UC and Chandra, H (2014). Estimation of domain mean using two stage sampling with sub-sampling of non-respondents. *J. Ind. Soc. Agril. Statist.,* **68(1)**, 39-54.

3. Arivalagan, M, Bhardwaj, R, Gangopadhyay, KK, Prasad, TV and Sarkar, SK (2013). Mineral composition and their genetic variability analysis in eggplant (*Solanum melongena L.*) germplasm. *J. Appl. Botany Food Qual.*, **86**, 99-103.

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6. Bhar, Lalmohan (2013). A diagnostic tool for detecting outliers in experimental data. *Model Assist. Statist. Appln.,* **8(1),** 61-68.

7. Bhattacharyya, P, Karak, T, Chakrabarti, K, Chakraborty, A, Paul, RK and Tripathi, S (2014). Is tsunami tremor jolted on microbial biomass and their activities in soils? - A case study in Andaman Island, India. *Environ. Earth Sci.,* DOI: 10.1007/s12665-014-3049-4**.**

8. Bhowmik, Arpan, Jaggi, Seema, Varghese, Cini and Varghese, Eldho (2013). Universally optimal second order neighbour designs. *Model Assist. Statist. Appln.,* **8**, 309-314.

9. Bhowmik, Arpan, Jaggi, Seema, Varghese, Eldho and Varghese, Cini (2012). Block designs balanced for second order interference effects from neighbouring experimental units. *Statist. Appln.*, **10(1-2)**, 1-12.

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## Popular Articles

सांख्यिकी-विमर्श 2013-14 , अंक-9 में प्रकाशित लेख

- कृष्ण कान्त त्यागी, अशोक कुमार गुप्ता एवं विजय बिन्दल। संस्थान के कीर्तिस्तम्भ : डॉ. ओम प्रकाश कथूरिया, 1—4

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4. Iquebal, MA, Sarika, Rai, Anil and Kumar, Dinesh (2014). World's first database based on tomato whole genome for gene mapping and variety identification.

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7. Kumar, Shiv, Kumar, Anil, Singh, DR, Arya, Prawin, Chaudhary, KR, Kanika and Kumar, Sandeep (2013). Evaluation of performance of protection of plant varieties and farmers' right authority (PPV&FRAs): An empirical investigation. *International Conference on Global IPR System and WTO Issues (GIPRS-2013)* held at CCSU, Meerut (U.P.) during Sept. 14-15, 2013. SR Scientific Publication, New Delhi (Eds. Gourav, SS, Dhaka, JK, Vmrao, VK, Singh, SP, Lal, SK and Gupta, Nidhi), 53-60.

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# 8

# 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 4).

**International Consultancy Services**

- Bangladesh Bureau of Statistics and Department of Agriculture Extension was provided consultancy in respect of unified harmonized crop-cutting methodology for rice yield estimation in Bangladesh. The unified methodology was proposed after field testing the methodology in Barisal and Rajshahi districts of Bangladesh. Training for implementation of proposed methodology was provided to 150 officials. Training was also provided in data processing and a training manual has also been prepared. The funds were provided by Food and Agricultural Organization.

- Provided consultancy to training relevant officials from private consultancy firms, UN and Government in Bhutan on study/research methodologies and Sampling Techniques. Lectures on different topics in sample surveys were delivered. The theory was illustrated with the help of examples and real data. Funds were provided by the UNICEF.

- Consultancy was provided in project "Statistics from Space – Support to Ethiopia to Improve Agricultural Statistics in Ethiopia". In particular the activities undertaken were as follows: (i) Reviewed the methodology and results of area frame/ list frame comparative agricultural surveys, (ii) Reviewed the procedures and criteria used in area frame stratification, sample allocation and selection in all sampling stages and segmentation criteria, (iii) Reviewed the conceptual and operational issues related to the application of the list frame and impact on the results, (iv) Reviewed the estimation procedures of totals, proportions, ratios and sampling errors, (v) Compared the area frame estimates with that of the list frame estimates, analyzed the discrepancies and made proposals for improving the sample design for future area frame/list frame survey methods, including sample sizes (EA, segments) required at zonal level reporting domains and the segment size, (vi) Revised proposal for methodology, combining estimates obtained from the list frame and area frame methods in order to provide comprehensive coverage of data needs of users and (vii) Made statistical comparison of data collected using the Paper and Pencil Interviews (PAPI) and the Computer Assisted Personal Interview (CAPI) questionnaires during the CAPI pilot survey.

- Consultancy was provided to Ministry of Agriculture and Fisheries, Sultanate of Oman and the following activities were undrtaken:

  ➢ Conducted training on 'Geographic Information System (GIS) and Remote Sensing applications in agriculture.

➢ Evaluated the existing resources, methodology and database available in the Department of Rangeland Resources.

➢ Assessed the human resources, materials (satellite images), software and technical capacity in place for the potential use of GIS and remote sensing for application in agriculture.

➢ Visited various ministries and had meetings with the officials working in the field of GIS regarding satellite data, toposheets and control points availability.

**Advisory Services**

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

- Experimental designs for Coordinated Wheat and Barley Trials at DWR, Karnal. The discussions were held on i) Layout for  AVTs when entries exceed 20; ii) Suitability of currently followed simple lattice designs in NIVTs; iii) Setting a limit for acceptance of data from centres with low CV; iv) Identifying the correct procedure for pooling of results and v) Evolving appropriate promotion criteria for entries in trials. It was decided that if entries are more than 20, then the experiment should be conducted using alpha lattice design and adjusted mean should be used for interpretation. Analysis of covariance should be used by taking plant stand as covariate in data analysis of salinity/alkalinity trials. Further, varieties which are significantly superior at 10% level of significance in NIVTs/IVTs and at 5% level of significance in AVTs with the best check of the trial are only to be considered for retention/ promotion.

- Ahmad Abdullah Saad a Ph.D. (Agronomy) student of IARI for combined analysis of data of split plot designs. The data were for the two years with four main plots and four sub-plots with three replications.

- Biswajit Mondal, Ph.D. student at Division of Genetics, IARI regarding use of Radar Chart for appropriate visualization of differences in two varieties through a multivariate data of several traits using Matlab software.

- Dr. D Balakrishnan, Scientist, DRR, Hyderabad on Path analyses for yield and blast resistance traits in Rice.

- Dr. Abhijit Kar, Division of Post Harvest Technology, IARI, New Delhi on analysis of experimental data using randomized complete block design and on graphical representation of analysis results.

- Dr. CR Mehta, Project Coordinator, AICRP on FIM concerning a sample survey on agricultural mechanization.

- Dr. M Meena, Scientist, Sugarcane Breeding Institute, Coimbatore on Stability analysis using Eberhart and Russell, Perkins and Jinks model, Freeman  and Shukla model, Additive Main Effects and Multiplicative Interaction (AMMI) analysis and Biplot analysis.

- Dr. Ahammed Shabeer TP, Scientist, NRC for grapes, Pune on the use of multiple comparison procedures and explained the procedure using SAS for the analysis of data pertaining to a study on biochemical characterization of oxidative enzyme activity from grape to raisins.

- Dr. Anil Kumar Gore, Public Health Foundation of India, New Delhi related to methodological issue on application of small area estimation in DLH and NFS data of the State of Uttar Pradesh.

- Dr. Aravind K Jukanti, Senior Scientist, CAZRI, Jodhpur on the analysis of data generated from an augmented randomized complete block design with 140 test and 5 check entries arranged in 7 blocks each of size 25. Also advised on obtaining genotypic variance-covarinace, phenotypic variance-covariance, heritability and genetic advance.

- Dr. Bhupender Kumar, Scientist, DMR, New Delhi on the use of discriminant analysis for finding the misclassification rate of genotypes into five different zones.

- Dr. Charanjit Kaur, Professor, Division of Post-Harvest Technology, IARI to use Box-Behnken design for an experiment on Multigrain Pasta, where the input variables are three different grains taken at three different levels and provided a randomized layout of the suggested design.

- Dr. Dibakar Mahanta, Scientist, VPKAS Almora on the use of contrasts analysis for comparing specific treatment effects and explained the procedure of contrasts analysis using SAS.

- Dr. Dinesh Kumar, Senior Scientist, Division of Agronomy, IARI, New Delhi for performing multiple comparison procedures using SAS in case of a two-factor factorial randomized complete block design.

- Dr. J Auxcilia, Assistant Professor from Department of Fruit Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore on the use of stepwise regression for identifying the most significant explanatory variables and studying their effects on yield of different varieties of Banana. Different explanatory variables involved in this study were Plant height, Stem girth, Leaf area, No. of leaves, Days to shoot, Days to harvest, Crop duration, No. of hands, Fingers per hand, Finger weight, Finger length, Finger girth etc. The stepwise regression analyses were performed separately for 47 different varieties of Banana.

- Dr. Kiran Gaikwad, Scientist, IARI, New Delhi in the Division of Genetics on the use of multivariate techniques for 10 characters and 112 data points of wheat variety (HD-2894) and gave interpretation on the results obtained.

- Dr. M Murugan, Associate Professor of Veterinary College and Research Institute, Tirunelvlei (TN) for the analysis of the experiment of feeding trial data Japanese quail to find out the effect of various feeds on its body weight in meat type birds. The data were analyzed using the technique of repeated measurements. The feeds, time points and interaction of feeds and time points were found to be significant.

- Dr. Pankaj Sharma, Sr. Scientist, Directorate of Rapeseed-Mustard Research (DRMR), Bharatpur on the development of forewarning models for percentage of Sclerotinia rot incidence (disease in mustard) for different date of planting in mustard crop.

- Dr. Subhdra Singh, Senior Scientist, Department of Genetics, CCS HAU, Hisar on the analysis of data pertaining to an experiment conducted using

α-design with parameters v = 105, b = 30, r = 2, k = 7 for evaluating 105 RILs of Wheat crop on 13 characters conducted for two years 2010-11 and 2011-12 in normal sown and late sown conditions. Also advised on analysis of variance for each of the 13 characters in each of the 4 environments, contrast analysis for RILs vs checks, path analysis, canonical correlation analysis, estimation of genotypic and phenotypic variance-covariance, correlations and heritability coefficient.

- Dr. Sunita Singh, Principal Scientist, IARI in the Division of Post Harvest Technology, IARI, New Delhi was advised for the Box-Behnken response surface method to optimize the response of Nisin on 3 levels of 9 response variables in 15 runs.

- Dr. Yasvir Singh Shivay, Principal Scientist, Division of Agronomy, IARI on Path analyses for the two data sets one for rice and another for wheat.

- Miss Nagma Kousar, Ph.D. Student of GB Pant University of Agriculture and Technology for constructing Selection Indices of 30 Lines using SAS Package.

- Mr. Sujit Sarkar, a Scientist from Division of Agricultural Extension, IARI on the use of princiiplal component analysis to work out Vulnerability index to assess and analyze farmers' vulnerability to climate change in Himachal Pradesh and Rajasthan by considering various dimensions of individual (attitudinal, knowledge, skill, value orientation) as well as social (interconnectedness and cohesiveness), Economic (physical resources) and Behavioural (innovativeness, risk orientation, achievement motivation, production orientation etc.).

- Ms. Anshida Beevi, a M.Sc. student from the discipline of Agricultural Extension, IARI on the use of Wilcoxon-signed-rank test for studying the change in the livelihood pattern of people in Lakshadweep during the last decade.

- Ms. Nimisha Agrawal, Ph.D. scholar of National Institute of Advanced Studies, Indian Institute of Science Campus, Bangalore on her research proposal specifically, sampling design, survey procedures and method of analysis.

- Professor MH Wani, Rajiv Gandhi Chair, SKUAST-K and his team regarding price forecasting of fruits and vegetables.

- Professor RM Pandey, Head, Department of Biostatistics and Ms. Mona Pathak, All India Institute of Medical Sciences, New Delhi on methodological issue on application of small area estimation in health survey data.

- Sh. Dibakar Ghosh, Scientist, Directorate of Weed Science Research, Jabalpur on the use of factorial experiments with extra treatment for studying the response of 6 different varieties of Mustard crop based on two factors viz. Time of Application and Doses of glyphosate. There were four levels of time of applications as 20, 30, 40 and 50 DAS. The factor doses of glyphosate had 5 levels as 40, 50, 60, 80 and 100 g/ha. Each treatment combinations with three replications and the experiment also consists of one control treatment.

- Sh. Ashish Khandelwal, a M.Sc. student from Agricultural Chemicals on use of two-way ANOVA for studying the mobility behaviour of kresoxim methyl in soil and further the procedure of multiple comparison was also explained along with the SAS code for doing the same.

- Sh. Rajesh Bishnoi, a M.Sc. student from the discipline of Agricultural Extension, IARI on the use of Wilcoxon-Mann-Whitney's tests for comparing various agricultural and animal husbandry activities of male and female to examine part of the influence of climate change on gender of Rajastan.

# RAC, Management Committee and IRC

## Research Advisory Committee (RAC)

The composition of Research Advisory Committee (RAC) of the Institute constituted for a period of three years w.e.f. June 12, 2013 is as follows:

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
   (Andhra Pradesh)

4. **Dr. Bal BPS Goel**                                  Member
   Former Director, IASRI,
   B-77, Naraina Vihar,
   New Delhi - 110 028

5. **Dr. SD Sharma**                                     Member
   Vice-Chancellor,
   Dev Sanskriti Vishwavidyalaya,
   Shantikunj-Gayatri Kunj,
   Haridwar-249 411
   (Uttarakhand)

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. Kanchan K Singh**                               Member
   Assistant Director General (Engg.)
   Indian Council of Agricultural Research,
   Krishi Anusandhan Bhavan - II, Pusa,
   New Delhi – 110 012

8. **Dr. UC Sud**                                        Member
   Director (A), IASRI, Library Avenue,
   New Delhi - 110 012

9. **Dr. Seema Jaggi**                          Member-Secretary
   Principal Scientist and
   Incharge, PME Cell, IASRI,
   Library Avenue,
   New Delhi - 110 012

The 15th meeting of the RAC of IASRI was organized on January 28, 2014 under the Chairmanship of Professor Bimal K Roy, Director, Indian Statistical Institute, Kolkata. The meeting was attended by Dr. Saumyadipta Pyne, Dr. SD Sharma, Dr. Bal BPS Goel, Shri GC Manna,  Dr. Kanchan K Singh, Dr. UC Sud as members of RAC of the Institute and Dr. Seema Jaggi, as Member Secretary, RAC. Dr. VK Gupta, National Professor, ICAR; Dr. Prajneshu, Emeritus Scientist and Former Head, Statistical Genetics, IASRI; Dr. RC Goyal, Emeritus Scientist and Former

Principal Scientist, IASRI and all Heads of Divisions, All Professors of IASRI also attended the meeting as special invitees.

Dr. Gupta presented a brief profile of the Honourable Chairman and other members and welcomed them. Dr. UC Sud, Director(A), IASRI, made a brief presentation on the functions and activities of the Institute. He informed the house that IASRI has received the ISO 9001:2008 certificate. He also presented the historical development, genesis, mandate, broad research programmes, significant research achievements and future research programmes of the Institute. Thereafter Chairman and Members gave their opening remarks and appreciated the efforts and achievements of the Institute.

Dr. Seema Jaggi, In-charge, PME Cell presented the research achievements and other related activities of the Institute during 2013. She presented the 73 research projects in which scientists of the Institute were involved during the year out of which 23 were externally funded. She apprised the members regarding 16 completed research projects and 18 new projects undertaken during the period. Besides, two projects under consultancy mode were also undertaken. It was also informed that XVII National Conference of Agricultural Research Statisticians was organized during November 27-28, 2013 at NDRI, Karnal. Five important sessions on Priorities for Research in Agricultural Statistics: Current Status and Future Challenges, Priorities for Informatics in Agricultural Research: Current Status and Future Challenges, Priorities for Human Resource Development in Agricultural Statistics and Informatics, Statistics and Informatics Interface with Agricultural

Engineering and Animal Sciences were organized. She also informed that this year the Institute had submitted applications to the Registrar, Office of Copyrights, New Delhi for registration of copyright for Indian NARS Statistical Computing Portal (Software), Knowledge Data Warehouse for Agricultural Research (KWAR), Indian NARS Statistical Computing Portal (Manual), Expert System for Maize Crop (MaizeAGRIdaksh), Web based Software for Survey Data Analysis (SSDA 2.0) and shRNA Pred (Version1.0) and with the efforts of Institute's Technology Management Unit (ITMU), the copyrights for all except shRNA Pred (Version1.0) have been received. The institute has also received the copyrights for Design Resources Server, Monograph on Hadamard Matrices and Alpha designs. She also highlighted the awards and recognitions won by the scientists of the Institute. Two scientists were awarded Fellow of Indian Society of Agricultural Statistics (ISAS), one scientist received Lal Bahadur Shastri Outstanding Young Scientist Award-2012 of ICAR in the field of Social Sciences, one received Fellow Award 2012 by Society of Applied Biotechnology in recognition of outstanding achievements and contributions to the field of bioinformatics and one scientist was awarded GR Seth Young Scientist Award from ISAS. Many scientists have received best paper awards and are nominated on Editorial Boards of national and international journals and one scientist served as an FAO consultant to Bangladesh on Harmonization and Dissemination of Unified Agricultural Production Statistics in Bangladesh. It was informed that the institute has established an Advanced Supercomputing Hub for OMICS Knowledge in Agriculture (ASHOKA) which was dedicated to the nation by Shri Sharad Pawar, Minister of Agriculture and Food Processing Industries, Government of India on 15th January 2014. The thrust areas for XII Plan were also presented under the broad six programmes of the institute and the futuristic approach of the institute was also presented. In this connection, Vision 2050 document has been prepared.

The details of the training and teaching activities of IASRI were presented by Dr. PK Malhotra. It was informed that during the year 02 Ph.D. (Agricultural Statistics), 07 M.Sc. (Agricultural Statistics) and 05 M.Sc. (Computer Application) students had completed their respective degrees. A land mark event is that the

Ph.D. programme in Bioinformatics has been approved by academic council of PG School, IARI, New Delhi and this programme would start from academic session 2014-15. It was also informed that during the year, 385 researchers have been trained through various training programmes.

Dr. VK Gupta, ICAR National Professor apprised the RAC about the research activities of the National Professor Scheme. He informed the house that during the year, he has published eight research papers on different topics of design of experiments and sample surveys. He explained that robustness of Balanced Incomplete Block (BIB) designs for multi-response experiments against loss of observations has been investigated. General method of constructing block design for comparing several test preparations with a single standard preparation in multiple parallel line assays and asymmetric parallel line assays has been obtained. Optimization technique based algorithms have been developed for obtaining efficient incomplete block designs for given number of treatments, blocks and block sizes. He informed that a Handbook of Experimental Designs, monographs on Calibration Approach to Estimation of Population Parameter through Probability Sampling of Finite Populations and Designs for Biological Assays are being prepared. Design Resources Server is strengthened by adding modules of online generation of block designs with block size 2 for factorial experiments with baseline parameterization and online generation of efficient incomplete block designs. Sample Survey Resources is also strengthened. The members were highly appreciative of the efforts made and said that results obtained are interesting, excellent and useful to NARS. Members also felt satisfaction on 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 Heads of the Divisions presented the research achievements of their respective Divisions.

After detailed discussions, the following action points were emerged:

1. New collaborations may be actively sought with other institutes in India and elsewhere specializing in diverse upcoming fields of study. The existing collaborations may also be strengthened.

2. Efforts should be made to take up projects that will address the estimation of loss due to environmental hazards, climate change etc.

3. Statistical models and methods, such as spatio-temporal models, hierarchical Bayesian models, etc., may be developed for predictive and integrative analyses of geo-referenced multi-sectoral data.

4. Futuristic approaches may include the increasingly new applications of BIGDATA in Agriculture. New robust methodological and applied research may be conducted to address the challenges of data which has high volume, variety and velocity. Web resources and service oriented computing may be strengthened.

5. High-throughput Epigenomic and Metabolomic studies of plants subjected to India-specific environmental and climatic stressors may be conducted to understand gene-environment interactions, etc.

6. Attempts should be made to explore the technique of small area estimation for obtaining reliable estimates at district/ disaggregate level.

7. Efforts should be made to undertake more research projects in computer applications besides contributing into projects of service mode.

8. 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. Efforts should be put with the ICAR to get rid of the "Specialization in Agriculture" requirement.

9. Scientists from IASRI may be deputed to ISI for attachment training and there should be more interaction and close association between IASRI and ISI, Kolkata.

10. The scientists of the institute may be sent for training in the core areas of Statistics and Informatics to international organizations of repute for enhancing their capabilities and providing an international exposure.

11. Efforts may be made to approach PG School, IARI, New Delhi for making a provision in which the students of Masters' degree programme in Agricultural Statistics and Computer Applications from IARI possessing B.Sc. in Statistics/ Mathematics may be given the option to offer

remedial courses as extra credit hours in each trimester so that they can complete their degree requirements without spending one extra year.

12. 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 (coming to the Institute from different Institutes and working for the Institute Projects).

**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 (constituted by the Council) by providing 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. Institute Management Committee (IMC) was reconstituted for a period of three years w.e.f. 27.08.2013 vide office order no. 7(1)/2013-Admn.II dated 17.09.2013 and the present IMC is as follows:

1. **Dr. UC Sud**     Chairman (Ex-Officio)
   Director (A), IASRI,
   Pusa, New Delhi-110 012

2. **Director of Agriculture**     Member
   Govt. of Delhi, ITO,
   New Delhi-110001

3. **Director of Agricultural Statistics &**
   **Crop Insurance**     Member
   Govt. of Uttar Pradesh,
   Lucknow, UP

4. **Joint Director (Research)**     Member
   IARI, Pusa, New Delhi-110 012

5. **Dr. (Smt.) Ravinder Kaur**     Member
   Project Director,     (up to 19.01.2016)
   Water Technology Centre,
   IARI, Pusa,
   New Delhi -110 012

6. **Dr. Suresh Pal**     Member
   Head, Division of     (up to 19.01.2016)
   Agricultural Economics,
   IARI, Pusa,
   New Delhi -110 012

7. **Dr. Niranjan Prasad**     Member
   Division of Processing &     (up to 19.01.2016)
   Product Development,
   IINRG, Ranchi

8. **Dr. (Smt.) Rajni Jain**     Member
   Principal Scientist,     (up to 03.07.2014)
   NCAP, 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

The 62nd meeting of IMC was held on 18 June 2013 under the Chairmanship of Dr. UC Sud, Director (A), IASRI. 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 reserch 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. Actual expenditure incurred up to March 31, 2013 in respect to Plan/Non-Plan of the Institute was also presented before the committee. Purchase of necessary equipments/items under XII plan EFC in the year 2013-14 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 (79th & 80th) of the IRC were held during September 30 - October 01, 2013 and March 21-22, 2014.

- In the 79th meeting, 11 new research projects (05 Institute funded and 06 outside funded) were approved and progress of 57 on-going research projects (31 Institute funded, 12 in collaboration with other Institutes and 14 outside funded) were discussed and 17 research projects were declared as complete.

- In the 80th meeting, 09 new research projects (03 Institute funded and 06 outside funded) were approved and progress of 49 on-going research projects (23 Institute funded, 08 in collaboration with other Institute and 18 outside funded) was reviewed and 05 research projects were declared as complete.

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

## PAPERS PRESENTED

- National Seminar on Recent Advances in Applied Statistics and its Application in Forestry (RAASAF) at Tropical Forest Research Institute, Jabalpur during 15-17 April 2013.

  - ➢ Pradhan, UK, Lal, Krishan*, Parsad, Rajender and Gupta, VK. Optimum conditions for mixture experiments with process variable for the expected response with minimum variability.

  - ➢ Parsad, Rajender, Gupta, VK and Lal, Krishan*. Design resources server.

  - ➢ Chandra, H* and Sud, UC. Importance of statistical software in survey data analysis. (invited talk)

  - ➢ Aditya, K* and Sud, UC. Estimation of domain total for unknown domain size in the presence of non-response.

  - ➢ Kumar, Amrender. Forewarning models for pests and diseases.

- International Conference on Impact of Technological Tools on Food Security under Global Warming Scenario (ITTFS 2012) at Shobhit University, Modipuram during 11-12 May 2013.

  - ➢ Singh, Ravindran*, Katiyar, Vijay Kumar, Islam, SN, Singh, Randhir and Verma, RPS. Expert system on barley crop management. (poster presentation)

- World Congress on Business, Finance, Marketing and Industrial Management for Sustainable Development (BFMIMSD - 2013) at Jawaharlal Nehru University, New Delhi during 25-26 May 2013.

  - ➢ Arya, Prawin*, Kumar, Shiv, Singh, DR, Kumar, Anil and N, Sivaramane. Market integration in mustard commodities in India.

  - ➢ Praveen, KV, Kumar, Shiv, Singh, Dharam Raj, Kumar, Anil, Arya, Prawin* and Chaudhary, Khyaliram. An analysis of price levels of selected food commodities under modern and traditional retailing formats in Kochi.

- National Seminar on Today's Innovations-Tomorrow's Sustainability in Allied Sciences, Technology, Management and Education at Dehradun during 25-26 May 2013.

  - ➢ Bhowmik, Arpan* and Varghese, Eldho. Statistical issues in experimental data analysis. (invited talk)

- First International and Third National Conference on Biotechnology, Bioinformatics and Bioengineering (BBB-2013) at Tirupati, Andhra Pradesh during 28-29 June 2013.

  - ➢ Iquebal, MA, Sarika, Dixit, SP, Rai Anil and Kumar, Dinesh*. BISGoat: Molecular markers based breed identification server for goat.

- International Conference on ITNASETSD – 2013 at Jawaharlal Nehru University, New Delhi on 27-28 July 2013.

  ➢ Kumar, Anil*, Choudhary, Vipin Kumar, Panwar, Sanjeev, Singh, DR, Arya, Prawin and Kumar, Shiv. Sustainability of crop sequences through diversification and intensification of crops.

- International Conference on Microfinance and Microentrepreneurship: Issues and Challenges organized by Department of Economics, Bhagat Phool Singh Mahila Vishwavidyalaya, Sonepat, Haryana during 08-09 August 2013.

  ➢ K, Vijith Krishnan, Kumar, Shiv*, Singh, DR, Aarthi, LR, Kumar, Anil, Arya, Prawin, Lohcab, Shaloo and Chaudhary, KR. Prevailing practices of paddy collective farming under kudumbashree mission in Kerala: An economic investigation.

- 1st National Seminar on Revitalizing Indian Agriculture "Innovations in Agro Processing and Value Chain" organized by Department of Agriculture and Environmental Sciences at National Institute of Food Technology Enterpreneurship and Management (NIFTEM), Kundali, Haryana during 12-13 August 2013.

  ➢ Madhav, JV*, Sethi, S, Kaur, C and Lal, Krishan. Modified atmosphere packed minimally processed garlic cloves – A convenience product.

- The First Asian International Statistical Institute Satellite Conference on Small Area Estimation, 2013 at Bangkok, Thailand during 01-04 September 2013.

  ➢ Chandra, H*, Salvati, N and Chambers, R. Nonstationary Fay-Herriot models for small area estimation. (invited talk in plenary session)

- 52nd All India Wheat and Barley Research Workers Meet at CS Azad Agricultural University, Kanpur on 02 September 2013.

  ➢ Islam, SN. Wheat expert system. (invited talk)

- 21st Annual Conference of Agricultural Economics Research Association at SKUAST-Kashmir, Srinagar during 10-12 September 2013.

- ➢ Gurung, Bishal. Volatility and co-integration in livestock and marine export data.

- ➢ Paul, RK. Forecasting of long memory time series.

- 3rd IFIP International Conference on Bioinformatics at Maulana Azad National Institute of Technology, Bhopal during 23-26 September 2013.

  ➢ Meher, Prabina Kumar*, Rao, AR and Sahu, Tanmaya Kumar. A di-nucleotide association based approach for donor splice site prediction.

  ➢ Rani, N*, Gupta, S and Rao, AR. Buffalo genome information resource.

  ➢ Rani, N, Jain, S, Sahu, TK and Rao, AR*. LEGMDB-HST: A legume microsatellite database for heat stress tolerance.

- First International Conference on Computational Intelligence: Modeling, Techniques and Applications (CIMTA 2013) at University of Kalyani, Kolkata during 27-28 September 2013.

  ➢ Sudeep. Building and querying microbial ontology.

- International Conference on Advancements in Computing Sciences, Information Techniques and Emerging E-Learning Technologies (ACSITEET-2013) at Jawaharlal Nehru University, New Delhi during 05-06 October 2013.

  ➢ Alam, Wasi* and Paul, AK. An alternative statistical approach for evaluating the efficiency of an insecticide.

  ➢ Dahiya, Shashi*, Bharadwaj, Anshu and Chaturvedi, KK. eLearning to support agricultural community.

  ➢ Paul, Amrit Kumar*, Wahi, SD, Paul, Ranjit Kumar and Alam, Wasi. Effect of non-normality and inadmissible estimates on estimation of heritability.

  ➢ Sharma, Anu*, Lal, SB, Mishra, DC, Srivastava, Sudhir and Rai, Anil. A web based software for synonymous codon usage indices.

- National Conference on Agro-biodiversity Management for Sustainable Rural Development at NAARM, Hyderabad during 14-15 October 2013.

  - Bharadwaj, Anshu* and Dahiya, Shashi. Managing sustainable agro-biodiversity: ICT Intervention.

- Sixth International Conference on Agricultural Statistics (ICAS-VI) at Rio-de-Janeiro, Brazil during 23-25 October 2013.

  - Sud, UC* and Chandra, Hukum. District level crop yield estimation under spatial small area model.

- 7th International Rice Genetics Symposium (RG7) organized at Manila, Philippines during 05-08 November 2013.

  - Balakrishnan, D*, Biswas, A, Robin, S, Rabindran, R and Joel, AJ. Generation mean analysis of yield and blast resistance related traits in rice (*Oryza sativa L.*). (poster presentation)

- XVII National Conference of Agricultural Research Statisticians organized jointly by IASRI, New Delhi and NDRI, Karnal at NDRI, Karnal during 27-28 November 2013.

  - Sud, UC. Small area estimation-some applications in India. (keynote address)

  - Ajit*, Dhyani, SK and Parsad, Rajender. Current status and future strategies in agroforestry research in the country: statistical perspectives.

  - Angadi, UB*, Chaturvedi, KK, Lal, SB and Rai, Anil. Thrust areas, present status and new approaches in agricultural informatics.

  - Arora, Alka. Priorities for research in informatics: current status and future challenges.

  - Chaturvedi, KK*, Rai, Anil, Lal, SB, Angadi, UB and Sharma, Anu. High performance computing and agricultural computing portal.

  - Choubey, AK. Priorities for research in informatics: current status and future challenges.

  - Iquebal, Mir Asif, Sarika, Mukhopadhyay, CS, Rai, Anil and Kumar, Dinesh*. Global status

of agricultural bioinformatics and genomics in India: issues and challenges.

  - Kumar, Dinesh* and Rai, Anil. Human resource development in agri-bioinformatics in India: issues and challenges.

  - Lal, SB*, Rai, Anil, Chaturvedi, KK, Angadi, UB and Sharma, Anu. Sequence submission portal: issues and challenges.

  - Parsad, Rajender* and Gupta, VK. HRD in agricultural statistics and informatics: some policy issues.

  - Prajneshu* and Ghosh, Himadri. Some priorities for research in statistical modelling: current status and future challenges.

  - Rao, AR. Handling big-data of Indian agriculture.

  - Rao, AR. Post-graduate teaching and training in bioinformatics: current status and future challenges in NARS.

  - Rao, AR*, Meher, PK and Wahi, SD. Statistical genetics: current scenario and future challenges.

  - Sahoo, Prachi Misra*, Rai, Anil and Ahmad, Tauqueer. Geoinformatics for agricultural research: current status and future challenges.

  - Sudeep. Priorities for human resource development in agricultural statistics and informatics.

  - Varghese, Cini. Designs for veterinary trials.

- International Conference on Bimolecular Simulations and Dynamics: Recent Advances and Future Perspectives-2013 organized by Indian Institute of Technology Madras (IITM), Chennai during 28-30 November 2013.

  - Gupta, Saurabh* and Rao, AR. Molecular modeling and dynamics simulations for identification of inter-domain communication of HSP70 in Indian camel. (poster presentation)

- International Conference on Advanced Information and Communication Technology organised at University of Sydney, Australia during 03-05 December 2013

➢ Chaturvedi, KK, Bedi, Punam, Misra, Sanjay* and Singh, VB. An empirical validation of the complexity of code changes and bugs in predicting the release time of open source software. (presented through Web)

● International Conference on Statistics 2013: Socio-economics and Sustainable Challenges and Solutions organized at CR Rao Advanced Institute of Mathematics, Statistics and Computer Sciences, Hyderabad during 28-31 December 2013.

  ➢ Parsad, Rajender * and Gupta, VK. Innovative applications of designs for factorial experiments in National Agricultural Research System. (invited talk)

● 67th Annual Conference of Indian Society of Agricultural Statistics organized at Institute of Agricultural Sciences, Banaras Hindu University (BHU), Varanasi during 18-20 December 2013.

  ➢ Aditya, K*, Sud, UC and Chandra, H. Some calibration estimators under two stage sampling design.

  ➢ Ahuja, Sangeeta. SPFE 2.0 (Statistical package for factorial experiments version 2.0

  ➢ Alam, Wasi. Study on robustness of sequential testing procedures for size based negative binomial distribution.

  ➢ Alam, Wasi*, Paul, Ranjit Kumar and Paul, Amrit Kumar. Prospects of livestock and dairy production in India under time series framework.

  ➢ Arya, Prawin*, Singh, DR, Singh, KN and Kumar, Anil. Determinants of tube wells installation and buying of groundwater: A north-western Rajasthan experience.

  ➢ Basak, P, Chandra, H* and Sud, UC. Prediction of finite population total under a log normal model.

  ➢ Bhar, Lalmohan. Forecasting in agricultural system: status and challenges. (invited talk)

  ➢ Bhowmik, Arpan*, Jaggi, Seema, Varghese, Eldho and Varghese, Cini. Optimal block designs under a non-additive mixed effects interference model. (in Dr. GR Seth Memorial Young Scientist Award session)

➢ Biswas, Ankur*, Ahmad, Tauqueer and Rai, Anil. Rescaling bootstrap technique for variance estimation for ranked set samples in finite population.

➢ Chandra, H* and Sud, UC. Geographical weighted regression approach for small area estimation – An application to crop yield estimation.

➢ Choubey, AK. Data mining techniques and its applications in agriculture. (invited talk)

➢ Das, Samarendra. A computational system biology approach to construct gene regulatory networks to salinity response in rice.

➢ Dash, Sukanta*, Parsad, Rajender and Gupta, VK. Efficient row-column designs with two rows.

➢ Gurung, Bishal*, Paul, Ranjit Kumar, and Ghosh, Himadri. Fitting smooth transition autoregressive nonlinear time-series model using particle swarm optimization technique. (in Dr. GR Seth Memorial Young Scientist Award session)

➢ Gurung, Bishal. Stochastic volatility in mean (SVM) model for modelling and forecasting volatile spices export data.

➢ Islam, SN. Developing e-Platform for seed spice growers.

➢ Jaggi, Seema, Varghese, Eldho*, Varghese, Cini and Bhowmik, Arpan. Construction of neighbour balanced block designs using BIB and PBIB designs.

➢ Jambhulkar, Nitiprasad N, Lal, Krishan*, Parsad, Rajender and Gupta,VK. Construction of regular and irregular fractional factorial plans with minimum aberration. (invited talk)

➢ Kumar, Anil* and Chaturvedi, Ajit. Bayesian estimation procedures for the reliability function and $P(X>Y)$ of inverse Weibull distribution under SELF and general entropy loss function (GELF).

➢ Kumar, Arvind, Varghese, Cini*, Varghese, Eldho and Jaggi, Seema. Experimental designs under three-way blocking structure.

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- ➢ Mishra, DC. Trait associated genes prediction tool using non-linear penalized SVM.

- ➢ Harun*, Varghese, Cini, Varghese, Eldho and Jaggi, Seema. Experimental designs involving three-way crosses for breeding trials.

- ➢ Nigam, Deepti, Smita, Shuchi, Mishra, DC, Lal, SB, Kumar, D, Rai, Anil and Kumar, Sanjeev*. Synergetic regulatory networks mediated by microRNAs and transcription factors under salinity and heat stress in Oryza spp.

- ➢ Panwar, Sanjeev. Use of nonlinear regression analysis for forecasting crop yield.

- ➢ Parsad, Rajender* and Gupta, VK. Design resources server. (invited talk)

- ➢ Paul, AK, Behera, Subrat Keshori, Iquebal, Asif and Wahi, SD*. Some aspect of estimation of heritability of mastitis disease.

- ➢ Paul, Ranjit Kumar. An application of long memory time series for forecasting commodity prices.

- ➢ Paul, Ranjit Kumar. Nonlinear time-series models and their applications in forecasting agriculture systems. (invited talk)

- ➢ Pal, S*, Prajneshu and Ghosh, H. Nonlinear growth models - estimation of compound growth rates for non-monotonic situations using WebECGR package.

- ➢ Sarkar, Susheel Kumar*, Lal, Krishan and Gupta, VK. Construction of linear trend-free multilevel fractional factorial experiments.

- ➢ Varghese, Cini*, Jaggi, Seema and Varghese, Eldho. On some developments in crossover designs. (invited talk)

- ➢ Varghese, Eldho* and Varghese, Cini. Efficient MERC designs for diallel cross experiments with specific combining abilities.

- ➢ Wahi, SD* and Paul, AK. Application of growth curve parameters in early selection of pigs.

- Workshop on Valuation and Pricing of Technologies at National Agricultural Science Centre Complex, New Delhi on 26 December 2013.

  - ➢ Singh, KN. Market research and technology foresight for valuation and pricing.

- National Symposium on Mushrooms for Medicinal and Nutritional Security under Changing Agro-climatic Conditions at Dr. YS Parmar UHF, Nauni (HP), during 27-28 December 2013

  - ➢ Gautam, Y*, Marwaha, S, Singh, Pal and Manikandan. IT based interactive advisory system for stakeholders of mushroom industry.

- International Conference on Computing, Informatics and Networks sponsored by AICTE organised at Hotel Crown Plaza, Rohini, Delhi during 03-04 January 2014.

  - ➢ Bharadwaj, Anshu* and Minz, Sonajharia. Inductive-analytical learning based stepwise support vector machine (SVM).

- International Conference on Biotechnology and Bioinformatics (ICBB-2014) at Pune during 01-02 February 2014.

  - ➢ Meher, PK*, Rao, AR, Sahu, TK and Wahi, SD. Eukaryotic donor splice site prediction using neural networks.

- 101st Indian Science Congress at University of Jammu, Jammu during 03-07 February 2014.

  - ➢ Bhowmik, Arpan. Optimal block designs under a non-additive two-sided interference effects model [presented in the ISCA young scientist award programme under Mathematical Science including Statistics section]

- 3rd International Plant Phenotyping Symposium organized by MS Swaminathan Research Foundation, Chennai during 17-19 February 2014.

  - ➢ Angadi, UB. Initiative of ASHOKA in indian agriculture research. (invited talk)

  - ➢ Sudeep. Visual image analysis for assessment of plant pigments and leaf area index in rice under pot culture condition and one poster on Imaging approaches in plant phenotyping workshop.

- Symposium on Accelerating Biology: Computing Life 2014 organized by CDAC, Pune at YASHADA, Rajbhavan Complex, Pune during 18-20 February 2014 .

  - ➢ Kumar, Sanjeev. Computational aspects of stress mitigation in agriculture through network biology approach.

- National Conference on Inference for Stochastic Process-Recent Trends and Ideas (NCISPRT1 2014) organised at Department of Agricultural Extension, Agricultural Economics and Agricultural Statistics (EES), Palli Siksha Bhavana, Institute of Agriculture, Visva-Bharati, West Bengal during 21-22 February 2014.

  ➢ Pal, S* and Mazumdar, D. Estimation of trend in rainfall over gangetic West Bengal.

- International Soybean Research Conference (SOYCON-2014) organized at Indore during 22-24 February 2014.

  ➢ Arora, Alka* and Jain, Rajni. Machine learning for diagnosis of soybean diseases.

- 16th  Annual Conference of Society of Statistics, Computer and Applications held at Bhagat Phool Singh Mahila Vishwavidyalaya (BPSMV), Sonepat, Haryana during 24-26 February 2014.

  ➢ Ahuja, Sangeeta. Statistical software package for performance ensemble of compound treatments in agroforestry research (PECTAR 1.0).

  ➢ Arora, Alka. ICAR-ERP - A solution for resource and financial management.  (invited talk)

  ➢ Arya, Prawin*, Singh, DR, Singh, KN and Kumar, Anil. Equity analysis in crop production in North-Western Rajasthan.

  ➢ Bharadwaj, Anshu*. Geostatistics and statistics data mining in agriculture.

  ➢ Chandra, H*, Basak, P and Sud, UC. Estimation of finite population total for skewed data. (invited talk)

  ➢ Dahiya, Shashi. Ontologies and semantic web in geoinformatics. (invited talk)

  ➢ Dash, Sukanta *, Parsad, Rajender and Gupta, VK. Efficient row-column designs for mixed level factorial experiments based on baseline parameterization.

  ➢ Farooqi, Samir*. Functional classification of genes using synonymous codon usage data of S. ruber. (invited talk)

  ➢ Gurung, Bishal. Statistical modelling for describing All-India rainfall through logistic smooth transition autoregressive (LSTAR) model.

  ➢ Lal, SB*, Rai, A, Sharma, A, Chaturvedi, KK and Angadi, UB. Accelerating biological data processing using parallel computing.

  ➢ Mishra, DC. Gene regulatory network analysis using partial least square (PLS) regression approach.

  ➢ Parsad, Rajender* and Gupta, VK. Web resources for research and dissemination in statistical sciences. (plenary talk)

  ➢ Paul, RK. Forecasting spot price of mustard in Mumbai using ARFIMA model.

  ➢ Sarkar, Susheel Kumar*, Lal, Krishan and Gupta, VK. Cost efficient linear trend-free multi-level factorial experiments. (invited talk)

  ➢ Sud, UC. Calibration estimators in survey sampling. (plenary talk)

  ➢ Sudeep.  MIS tool for managing academic activities of a university.  (invited talk)

  ➢ Sudeep. ICT initiatives for human resources development in agricultural education. (invited talk)

  ➢ Yadav, SK, Lal, Krishan*, Parsad, Rajender and Gupta, VK. Robust $2^k$ factorial experiments with logistic error distribution. (invited talk)

- National Conference on Science of Omics for Agricultural Productivity: Future Perspectives at GB Pant University of Agriculture & Technology, Pantnagar (Uttarkhand) during 04-06 March 2014.

  ➢ Angadi, UB. Initiative of ASHOKA in indian agriculture bioinformatics research. (invited talk)

- 8th INDIACom: 2014, International Conference for  Computing for Sustainable Development, organized by Bharti Vidhyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi  during 05- 07 March 2014.

  ➢ Singh, Pal*, Sudeep, Arora, Alka, Goyal, RC and Malhotra, PK. Project information and management system of ICAR (PIMS-ICAR).

➢ Das, Suvajit, Dahiya, Shashi*and Bharadwaj, Anshu. An online software for decision tree classification and visualization using C4.5 algorithm (ODTC).

● NAIP-NABG Workshop on Bioinformatics Assisted Biological Research: Microbial Perspective at NBAIM, Mau during 24-25 March 2014.

➢ Kumar, Sanjeev. Microbial bioinformatics: A systems biology perspective. (invited talk)

➢ Kumar, Dinesh. Domestic animal ruminant metagenomics: A gold mine for new genomic resources. (invited talk)

● International Symposium on Plant Signaling and Behaviour at Delhi University during 07-10 March 2014.

➢ Grover, Monendra. Heat stress signaling in plants as context sensitive language acceptance problem. (poster presentation)

## RADIO TALK

● Dr. Yogesh Gautam delivered a Radio Talk on बच्चों की इन्टरनेट से सुरक्षा on 08 May 2013.

## INVITED LECTURES DELIVERED

### Dr. Rajender Parsad

● Two lectures on SAS: An Overview during Summer School on Decision Support System in Agriculture using Quantitative Techniques organized at NCAP, New Delhi during 02-22 August 2013.

● Three lectures on Design Resources Server, Consortium Website, Indian NARS Statistical Computing Portal and Sample Survey Resources Server during 4th Installation training-cum-Nodal Officers workshop organized at CIFE, Mumbai during 29-30 August 2013 under the aegis of NAIP Consortium on Strengthening Statistical Computing for NARS.

● One lecture on Designing of Experiments and Analysis of Data in Plant Genetic Resource Management in the Training programme on Management of Plant Genetic Resources at NBPGR, New Delhi during 16-25 September 2013.

● Three lectures on SAS: An Overview and Fundamentals of Design of Experiments during

Training Programme on Advances in Methodologies Paradigm and Tools in Extension Research organized at Division of Agricultural Extension, IARI, New Delhi under the aegis of CAFT during 17 September - 07 October 2013.

● Two lectures on SAS: An Overview during Training Programme on Teaching of Post graduate Courses in Horticulture for five teachers from Afghanistan, organized at IARI, New Delhi during 01 August 2013 to 31 January 2014.

● Seven lectures (i) Functions and Activities of IASRI; (ii) MS-EXCEL; (iii) Statistics: Introduction and Concepts; (iv) SAS: An Overview; (v) Principles of Design of Experiments; (vi) Design Resources Server and (vii) Indian NARS Statistical Computing Portal during International faculty Training for Afghan Nationals on Teaching of Post Graduate Courses in Agronomy organized by the Division of Agronomy, IARI, New Delhi during 01 July - 31 December 2013.

● Two lectures on SAS: An overview during Training programme on Price Forecasting using SAS Software under Network Project on Market Intelligence organized by NCAP, New Delhi during 03-04 January 2014.

● One lecture on Design and Analysis of Varietal Trials in Brainstorming Session on Experimental Designs for Coordinated Wheat and Barley Trials held at DWR, Karnal on 16 January 2014.

● Two lectures on SAS: An Overview and Multivariate Analysis to the participants of the Subject Matter training programme for the scientists from Islamic Republic of Afghanistan organized at Agricultural Extension Division of IARI, New Delhi during 01 August 2013 - 31 January 2014.

● Two lectures on SAS: An overview during of the training programme on Markets, Trade and Institutions for Agricultural Development organized at Division of Agricultural Economics, IARI, New Delhi during 27 January - 16 February 2014 under the aegis of CAFT of ICAR.

● Two lectures on Statistics: Introduction and Concepts and Fundamentals of Design of Experiments to the participants of the Workshop on Statistics organized at Center for Environment Science and Climate Resilient Agriculture, IARI, New Delhi during 07-10 February 2014.

- Two lectures on Indian NARS Statistical Computing Portal and Design Resources Server during Training programme organized by NDRI, Karnal at SKUAST-Jammu during 17-22 March 2014. The lecture was delivered through Google Hangouts.

**Dr. Anil Rai**

- A lecture on Remote Sensing and GIS Applications in Agriculture during Training of Officers of Indian Economic Services, Department of Economic Affairs, Ministry of Finance, Government of India at NCAP, New Delhi during 28 October - 01 November 2013.

- A lecture on Introduction to Agricultural Bioinformatics during CAFT training program on Techniques for Improvements in Plants and Human Health during 15 November - 05 December 2013 in Biochemistry Division of IARI, New Delhi.

- A lecture on GIS and Remote Sensing during Training program for Officers-Trainees of Indian Economic Services, Department of Economic Affairs, Ministry of Finance during 23-27 December 2013 at NCAP, New Delhi.

**Dr. Seema Jaggi**

- Two lectures on SPSS: An Overview during Summer School on Decision Support System in Agriculture using Quantitative Techniques organized at NCAP, New Delhi during 02-22 August 2013.

- Three lectures on SPSS: An Overview and Tests of Significance during Training Programme on Advances in Methodologies Paradigm and Tools in Extension Research organized at Division of Agricultural Extension, IARI, New Delhi under the aegis of CAFT scheme during 17 September - 07 October 2013.

- Four lectures on Statistical Tools and SPSS along with hands on session during training programme on Research Methodology at Council for Social Development, New Delhi during 18-28 September 2013.

- Five lectures on (i) Descriptive Statistics; (ii) SPSS: An Overview; (iii) Descriptive Statistics using SPSS; (iv) Testing of Hypothesis; and (v) Testing of Hypothesis using SPSS in Subject Matter training programme for the scientists from Islamic Republic of Afghanistan organized by Agricultural Extension

Division of IARI, New Delhi during 01 August 2013 - 31 January 2014.

- Two lectures on SPSS: An Overview and SPSS for Regression Analysis during CAFT training on Markets, Trade and Institutions for Agricultural Development during 27 January-16 February 2014 in the Agricultural Economics Division of IARI, New Delhi.

**Dr. Krishan Lal**

- Two lectures on Statistical Techniques and Soil Quality Assessment in Summer School on Soil Health Assessment Techniques organized at Division of Soil Science and Agricultural Chemistry, IARI, New Delhi during 04-24 June 2013.

- Three lectures on SAS: An Overview and Fundamentals of Design of Experiments in a CAFT training on Advances in Methodologies Paradigm and Tools in Extension Research organized at Division of Agricultural Extension, IARI, New Delhi under the aegis of CAFT during 17 September - 07 October 2013.

- Eight lectures (i) Basic Statistics, (ii) Testing of Hypothesis, (iii) ANOVA and ANCOVA, (iv) Basic Designs, (v) Split and Strip Plot designs, (vi) MANOVA, (vii) PCA and (viii) Design Resources Server during NAIP Training Programme on Strengthening Statistical Computing for NARS at MPUAT Udaipur during 25-30 November 2013.

- Two lectures on Design Resources Server and Basic Designs using SAS during one day sensitization Workshop of Data Analysis using SAS under NAIP Consortium Strengthening Statistical Computing for NARS at IIVR, Izatnagar on 20 December 2013.

- Seven lectures on Basic Designs with Practical, Correlation and Regression Analysis with Practical and Design Resources Server during the Training Programme for Afghan Nationals on Teaching of Post Graduate Courses in Agronomy on Experimental Designs during 31 October - 07 November 2013 at IASRI, New Delhi.

**Dr. Dinesh Kumar**

- Ten lectures i) Quality Checking of DNA Sequencing Data/ Chromatogram, ii) Gene Bank

Submission Tools, iii) Primer Designing for Real Time PCR, SNP, STR Genotyping, iv) SNP Mining Tools, v) STR Data Generation using Window based Tools, vi) Microarray Probe Designing Tools, vii) PCR-RFLP Test Development Tools, viii) STR Based Tools for DNA Signature of Fish Breeds/ Varieties, ix) Phylogenetic Tree Making Tools for SNP and STR Data and x) SNP Genotyping Tools for Tetra Arm PCR at CIFE, Mumbai to M.F.Sc. and Ph.D. Scholars: Fish Bioinformatics: theory and practical(s) during 30 April - 01 May 2013.

- Two lectures on Role of Bioinformatics in Animal and Crop Improvement and Practical on Genome Annotation and Bioinformatics Tool for DNA Signature of Breeds and Practical on SNP Mining and Primer Designing during Summer School on Recent Advances in Bioinformatics for Quality Livestock Production organized at Bioinformatics Centre, Tamil Nadu Veterinary and Animal Sciences University, Chennai during 02-22 May 2013.

- A lecture on IP Strategy in Bioinformatics at Management Development Programme (MDP) on Biotechnology and Intellectual Property Right during 08-12 July 2013 sponsored by NAIP held at National Academy of Agricultural Research Management (NAARM), Hyderabad.

- A lecture on Challenges in Animal Bioinformatics/ Genomics Approach to Enhance Domestic Animal Productivity in India during Brain Storming Session on Bioinformatics in Agriculture: Way Forward organized on 12 July 2013 at National Academy of Agricultural Sciences (NAAS), NASC Complex, New Delhi.

- A lecture on Application of Bioinformatics in Germplasm Identification and Improvement during Postgraduate Course on Biotechnology and Bioinformatics at Ambala College of Engineering and Applied Research, Ambala, Haryana on 03 October 2013.

- A lecture on Handling Next Gen Seq vis-à-vis Bioinformatics during National Workshop on Bioinformatics Approaches in Agriculture under Agri-Bioinformatics Project of Ministry of Information Technology, New Delhi at Directorate of Wheat Research, Karnal during 10-12 October 2013.

- A lecture on Global status of agricultural bioinformatics: challenges for India during a workshop cum training programme on Application of Bioinformatics Tools and Techniques in Fisheries, Aquaculture and Life Sciences held at Bioinformatics Centre, College of Fisheries Sciences, Central Agricultural University, Lembucherra, Agartala, Tripura during 21-23 October 2013.

- Delivered a lecture on Global Status of Agricultural Bioinformatics: Challenges for India during the workshop cum training programme on Application of Bioinformatics Tools and Techniques in Fisheries, Aquaculture and Life Sciences held at Bioinformatics Centre, College of Fisheries Sciences, Central Agricultural University, Agartala, Tripura during 21-23 October 2013.

- A lecture on Bioinformatics Tool for Microbial Identification along with hands on Bioinformatics Tools for Microbial Species Signature during National Training on Computational Tools for Microbial Research under National Agricultural Bioinformatics Grid (NABG) project during 19-30 November 2013 at National Bureau of Agriculturally Important Microorganisms, Mau Nath Bhanjan, UP.

- A lecture and hands-on Computational Approach for Classification and Identification of Animal Breeds during Subject Matter training programme on Computational Tools for Animal Genome Resource Data Analysis during 02-13 December 2013 at NBAGR, Karnal.

**Dr. AR Rao**

- A lecture on Statistics for Agricultural Development during Statistics Day celebrated at Department of Agricultural Statistics and Social Sciences, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur on 29 June 2013.

- A lecture on Centre for Agricultural Bioinformatics and its role in Agricultural Bioinformatics Research in India during DBT-supported brainstorming session on Prioritizing Research Areas on Nano-Bio-Information Technology for Development of North-Western Himalayan States organized during 12-13 July 2013 by Department of Molecular Biology and Genetic Engineering, College of Basic

Sciences and Humanities, GB Pant University of Agriculture and Technology, Pantnagar, Uttarakhand.

- A lecture on Application of R-Package for Crop Bioinformatics during Workshop cum Hands-on-Training on Use of Bioinformatics in Crop Biotechnology organized at Department of Genetics and Plant Breeding, Ch. Charan Singh University, Meerut, UP during 06-08 January 2014.

### Dr. LM Bhar

- Eight lectures (i) Regression Diagonstics, (ii) Non-linear Models, (iii) Probit Analysis, (iv) Logistic Regression, (v) Analysis of Repeated Measurement Data, (vi) Principal Component Analysis, (vii) Factor Analysis and (viii) Soil Quality Index during Training Programme on Data Analysis using SAS under NAIP Consortium Strengthening Statistical Computing for NARS at Indian Institute of Soil Science (IISS), Bhopal during 09-13 December, 2013.

### Dr. Hukum Chandra

- A lecture on Overview of R Software during Summer School on Decision Support System in Agriculture using Quantitative Techniques organized at NCAP, New Delhi during 02-22 August 2013.

- Two lectures on R Software: An overview and Data Analysis using R during Training programme on Statistical Software R held at the Computer Science and Applied Maths. Department, South Asian University, New Delhi on 13 April 2013.

- Eight lectures on Statistical Computing using R during Workshop on Statistical Computing using R at Department of Statistics, University of Delhi during 14-15 September 2013.

- Two lectures on R Software-An Overview during Training Programme on Advances in Methodologies Paradigm and Tools in Extension Research organized at Division of Agricultural Extension, IARI, New Delhi under the aegis of CAFT during 17 September-07 October 2013.

- Five lectures i) An Introduction to R Software, ii) R Graphics, iii) Import and Export of Data in R, iv) Statistical Analysis using R and v) R Functions

during Training programme on R-biological computing and applications organised at Institute of Bioresources and Sustainable Development, Imphal, Manipur during 14-15 March 2014.

### Dr. Amrit Kumar Paul

- Three lectures on SPAR, MS EXCEL and SAS Macro during International Training Programme on Teaching of Post Graduate Courses in Horticulture at Horticulture Division, IARI, New Delhi on 04 October 2013.

### Dr. Monendra Grover

- A lecture on Quantum Computation in Biological Networks during Subject-Matter training on Bioinformatics Approach in Genomics, Transcriptomics and Proteomics during 12-22 November 2013 under the NAIP funded project Establishment of National Agricultural Bioinformatics Grid (NABG) in ICAR at NBFGR, Lucknow.

- A lecture on Quantum Computation in Biological Networks during Bioinformatics: Invitro to Insilico Approaches in Entomology at NBAII, Bangalore during 18-30 November 2013.

- A lecture on Quantum Computation in Biological Networks with Special Reference to Abiotic Stress Networks during National Training on Computational Tools for Microbial Research under National Agricultural Bioinformatics Grid (NABG) project during 19-30 November 2013 at National Bureau of Agriculturally Important Microorganisms, Mau Nath Bhanjan, UP.

- A lecture on Quantum Computation in Biological Networks with Special Reference to Biotic Stress during National Symposium on Emerging Trends in Agri-Bioinformatics (ETAB) under Agri-Bioinformatics Promotion Programme at DWR, Karnal during 16-17 December 2013.

### Dr. Cini Varghese

- Two lectures on Data Analysis with EXCEL during training programme on Advances in Methodologies Paradigm and Tools in Extension Research organized at Division of Agricultural Extension, IARI, New Delhi under the aegis of CAFT during 17 September - 07 October 2013.

- Three lectures on (i) MS-EXCEL: An Overview; (ii) Hands on MS-EXCEL; (iii) Basic Statistical Procedures using MS-EXCEL in Subject Matter training programme for the scientists from Islamic Republic of Afghanistan organized by Agricultural Extension Division of IARI, New Delhi during 01 August 2013 - 31 January 2014.

**Dr. Sudeep**

- A lecture on PIMS-ICAR and HYPM during Management Development Programme on PME at NAARM Hyderabad during 18-23 November 2013.

- A lecture on Information systems for Agricultural Extension in India during International training programme on IT Application for Agricultural Extension (e-Extension) for officers of ASEAN Members Nations organized during 06-18 January 2014 at NAARM, Hyderabad.

**Dr. Ranjit Kumar Paul**

- A lecture on Linear Time Series Analysis in the training programme on Advances in Methodologies Paradigm and Tools in Extension Research organized at Division of Agricultural Extension, IARI, New Delhi under the aegis of CAFT during 17 September - 07 October 2013.

- Two lectures on ARCH and GARCH Models and ARIMA Models during Training programme on Market Intelligence held at NCAP, New Delhi during 17-18 October 2013.

- Three lectures on ARIMA Models and two lectures on Demonstration of ARCH/GARCH Models using a Case Study during training programme on Price Forecasting Using SAS Software under Network Project on Market Intelligence organized by NCAP, New Delhi during 03-04 January 2014.

- One lecture on ARIMAX-GARCH-WAVELET Technique for Forecasting Volatile Crop Yield at Applied Statistics Unit, Indian Statistical Institute, Kolkata on 19 February 2014.

**Dr. Yogesh Gautam**

- Two lectures on Cyber Law and Information Technology Act 2000 in training programme for Physics Lecturers at SCERT, Solan (HP) during 06-13 May 2013.

**Dr. MA Iquebal**

- A lecture on STR Markers and its Application in Agriculture under a DBT funded Workshop Cum Training Programme on Computational Techniques for Biological Data Mining organised at Agricultural Knowledge Management Unit (AKMU), IARI, New Delhi on 26 March 2014.

**Sh. Sanjeev Kumar**

- A lecture on Computational Aspects of Stress Mitigation in Agriculture through Network Biology Approach at CDAC, Pune on 19 February 2014.

- A lecture on Microbial Bioinformatics: A Systems Biology Perspective during the Workshop on Bioinformatics Assisted Biological Research: Microbial perspective organised at NBAIM, Maunath Banjan on 25 March 2014.

**Sh. PK Meher**

- A lecture on R-Package for Bioinformatics during Workshop cum Hands-on-Training on Use of Bioinformatics in Crop Biotechnology organized at Department of Genetics and Plant Breeding, Ch. Charan Singh University, Meerut, UP during 06-08 January 2014.

**Dr. Anil Kumar**

- One lecture on Hands on SAS in Subject Matter training programme for the scientists from Islamic Republic of Afghanistan organized by Agricultural Extension Division of IARI, New Delhi during 01 August 2013 - 31 January 2014.

**Dr. Eldho Varghese**

- Three lectures on (i) Hands on SPSS; (ii) Nonparametric Tests; and (iii) Practical on Nonparametric Tests in Subject Matter training programme for the scientists from Islamic Republic of Afghanistan organized by Agricultural Extension Division of IARI, New Delhi during 01 August 2013 - 31 January 2014.

**Dr. Sukanta Dash**

- Two lectures on JMP Genomics and SAS Enterprises Guide during one day Sensitization Workshop of Data Analysis using SAS under NAIP Consortium Strengthening Statistical

Computing for NARS at IIVR, Varanasi on 20 December 2013.

- One lecture on Multivariate Techniques in Subject Matter training programme for the scientists from Islamic Republic organized by Agricultural Extension Division of IARI, New Delhi during 01 August 2013 - 31 January 2014.

- Four lectures on JMP Genomics at NDRI, Karnal, two on 16 January and two on 21 February 2014.

- Four lectures on (i) Multivariate Analysis using SPSS; (ii) Cluster Analysis using SPSS, (iii) Principal Component Analysis using SPSS and (iv) Discriminant Analysis using SPSS during International Faculty Training for Afgan Nationals on Teaching of Post Graduate Courses in Agronomy organized by the Division of Agronomy, IARI, New Delhi during 01 July - 31 December 2013.

**Dr. Arpan Bhowmik**

- Three lectures on (i) Hands on MS-EXCEL: Statistical Procedure; (ii) Practical on Correlation and Regression Analysis using SPSS and (iii) SPSS Graphics in Subject Matter training programme for the scientists from Islamic Republic of Afghanistan organized by Agricultural Extension Division of IARI, New Delhi during 01 August 2013 - 31 January 2014.

**PARTICIPATION**

**Conferences/Workshops/Seminars/Symposia etc.**

- Workshop for Data Controllers on Open Government Data under National Data Sharing and Accessibility Policy (NDSAP) Implementation held at India Habitat Centre, New Delhi on 04 April 2013 organized by National Informatics Centre (NIC), Department of Electronics and Information Technology (DeitY), Ministry of Communication and Information Technology. (Dr. UC Sud, Dr. AK Choubey and Dr. Seema Jaggi)

- 43rd Annual Group Meeting of All India Coordinated Sorghum Improvement Project held at DSR, Hyderabad during 20-22 April 2013. (Dr. Rajender Prasad)

- 2nd Annual Workshop of NICRA held during 17-19 June 2013 at IARI, New Delhi. (Dr. Ranjit Kumar Paul)

- Training-cum-Workshop on Breed Survey and Integrated Sample Survey Methodology organized by Department of Animal Husbandry, Dairying and Fisheries, MoA, GoI at India International Centre, New Delhi during 05-07 June 2013 (Also made a presentation on Methodology of Integrated Sample Survey and Sample Selection before the participants on 07 June 2013). (Dr. UC Sud and Dr. KK Tyagi)

- Technical Committee of Direction (TCD) organized by Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Govt of India during 05-06 July 2013 at Guru Nanak Dev University, Amritsar. A presentation on Methodological aspects related to estimation of area and production of fodder crops, highlighting the related projects undertaken in the past by the Institute was also made. (Dr. UC Sud and Dr. KK Tyagi)

- Workshop on Developing Performance Indicators for ICAR institutes at NCAP, New Delhi on 15 July 2013. (Dr. UC Sud and Dr. Seema Jaggi)

- CAFT Workshop on ICT for Capacity Building in Agricultural Education in India organized by CAFT in Agricultural Statistics and Computer Application at IASRI New during 26-27 July 2013. (Dr. UC Sud, Dr. PK Malhotra, Dr. Anil Rai, Dr. Sudeep and Dr. Alka Arora)

- International Expert Consultation Meet Organized by National Bureau of Fish-Genetic Resources (NBFGR), Lucknow in collaboration with Asian Fisheries Society, Indian Branch (AFSIB), Mangalore and Aquatic Biodiversity Conservation Society (ABCS), Lucknow, on Fish Genomics Research in India: A Way Forward on 02 August 2013 at NBFGR, Lucknow. (Dr. Dinesh Kumar)

- One day workshop on #OpenDataApps Challenge for Innovation in Governance held at India Habitat Centre, New Delhi organized by NIC, Department of Electronics & IT on 08 August 2013. (Dr. Anshu Bharadwaj)

- The 50 Pact, organized by CIMMYT, BISA and ICAR during 16-17 August 2013 at NASC Complex, New Delhi. (Dr. Sushila Kaul)

- National Workshop on Repeat Study on Assessment of Post Harvest Losses of Major

Horticultural Crops, Animal and Fishery Products in India held on 29 August 2013 at NASC complex, New Delhi organized jointly by Horticulture SMD of ICAR and Ministry of Food Processing Industries, Govt. of India. (Dr. UC Sud, Dr. Anil Rai, Dr. KK Tyagi, Dr. Tauqueer Ahmad, Dr. Prachi Misra Sahoo and Dr. Man Singh)

- Workshop on Animal Bioinformatics and Genomics Research Programs under National Agricultural Bioinformatics Grid (NABG) organized under NAIP Subproject Establishment of National Agricultural Bioinformatics Grid on 02 September 2013 at NBAGR. (Dr. Dinesh Kumar)

- Two days workshop on Statistical Computing using R at The Department of Statistics, University of Delhi, Delhi during 14-15 September 2013. (Dr. Hukum Chandra)

- Global Economic Cooperation: Views from G20 countries organized by ICRIER at Indian Habitat Centre, New Delhi on 17 September 2013. (Dr. Sushila Kaul)

- 6th Agriculture Leadership Summit 2013 organized by Agriculture Today concurrently with the Leadership Awards and the release of 6th Agriculture Year Book during 19-20 September 2013 at Hotel Taj Palace, New Delhi. (Dr. KK Tyagi and Dr. Sushila Kaul)

- 4th Installation training-cum-Nodal Officers workshop organized under the project Strengthening Statistical Computing for NARS at IVRI, Izatnagar during 20-21 September 2013 and at NDRI Karnal on 30 September 2013. (Dr. Rajender Parsad)

- 29th workshop of AICRP on PHT held during 23-26 September 2013 at Maharana Pratap University of Agriculture and Technology (MPUAT), Udaipur, Rajasthan. (Dr. Anil Rai and Dr. Tauqueer Ahmad)

- One day workshop on NDSAP on October 08, 2013. (Dr. UC Sud)

- 2nd NKN (National Knowledge Network) Annual Workshop on Enhancing Research Collaborations through NKN organised at IISC Bangalore during 17-19 October 2013. (Sh. Rakesh Kumar Saini)

- Brain-Storming Workshop on Land Use Planning for Multifunctional Agriculture and Land Use Policy on 18 October 2013 at NASC Complex, New Delhi. (Dr. UC Sud)

- Workshop on Climate Change Statistics organized by Global Change Programme, Jadavpur University, Kolkata during 24-25 October 2013. (Dr. RK Paul)

- Workshop on Integration and mainstreaming of the activities under three mega projects of the Council: BAM, NABG and Phenomics (NFBSFARA) on 09 November 2013, Chaired by Hon'ble Secretary DARE & DG ICAR & Co-Chaired by Dr. Mangala Rai, Adviser to CM, Govt. of Bihar & Former Secretary DARE & DG ICAR. (Dr. Anil Rai and Dr. Dinesh Kumar)

- Workshop on Mapping the Cultural Authority of Science across Europe and India (MACAS-EU & India 2012-14) on 23 November 2013. (Dr. KN Singh and Md. Wasi Alam)

- 2 days Manthan awards Programme at India Habitat Centre during 05-06 December 2014. An IASRI stall was also put up at the venue for demonstrating the Expert System on Seed Spices. (Sh. SN Islam, Ms. Shashi Dahiya and Sh. RK Saini)

- NAIP cross cutting workshop held at ISI, Kolkata during 03-04 December 2013. (Dr. Rajender Parsad)

- NAIP Workshop on Cross Cutting Experiences in ICT sub-Projects during 06-07 December 2013. (Dr. Rajender Parsad)

- ICAR Vice Chancellors' and Directors' Conference during 19-20 January 2014 at Pune. A presentation on Internet Protocol Version 6 (IPv) was also made. (Dr. UC Sud and Dr. AK Choubey)

- Asia-Africa Agribusiness Forum – An International Conference, New Delhi during 04-06 February 2014. (Dr. Hukum Chandra)

- All India Training Workshop for 5th Minor Irrigation Census held at CSMRS, New Delhi on 25 February 2014 organized by Ministry of Water Resources, Govt. of India. (Dr. Tauqueer Ahmad)

- Workshop on Introduction to BioHPC on 19 February 2014 at Institute of Biotechnology,

Cornell University, Ithaca, NY, USA. (Sh. KK Chaturvedi)

- 3rd BTI Bioinformatics Course Workshop at Boyce Thomson Institute, Cornell University, Ithaca, NY USA during 25 February-01 April 2014. (Sh. KK Chaturvedi)

- Final Workshop on ICAR as the Catalysing Agent for Management of Change in Indian NARS: NAIP Component I organized at NASC Complex, New Delhi during 07-08 March 2014. (Dr. Rajender Parsad, Dr. AK Choubey and Dr. Alka Arora)

- Workshop on Linux for Biologists on March 10 and 17, 2014 at Institute of Biotechnology, Cornell University, Ithaca, NY, USA. (Sh. KK Chaturvedi)

- Workshop on Managing agricultural price risk: implication for India held at NCAP, New Delhi on 19 March 2014. (Dr. Ranjit Kumar Paul)

- NISAGEnet workshop organized at MPKV, Rahuri, Maharashtra during 19-20 March 2014. (Dr. Alka Arora)

- Workshop on Logistic Regression for Response with More Than Two Categories on 26 March 2014 at Cornell Statistical Consulting Unit (CSCU), Cornell University, Ithaca, NY, USA. (Sh. KK Chaturvedi)

- Workshop on Agricultural Research Connections on 27 March 2014 at College of Agriculture and Life Sciences (CALS), Cornell University, Ithaca, NY, USA. (Sh. KK Chaturvedi)

- Workshop on Improving Effectiveness of Acceptance Testing in ICT projects organized by DEFT education and learning institute at IHC, New Delhi during 27-28 March 2014. (Dr. Sudeep and Dr. N Srinivasa Rao)

### Krishi Vigyan Mela

Institute participated in the Krishi Vigyan Mela 2014 held at IARI, New Delhi during 26-28 February 2014. Web Resources developed by IASRI, Maize AgriDakdh, Expert System on Wheat Crop Management, Mushrooms, Seeds Spices, Agropedia etc. were demonstrated to visitors, researchers and farmers.



### Manthan Digital Bazaar

Institute participated in the Manthan Digital Bazaar at India Habitat Center, New Delhi during 05-06 December 2013. Expert System on Seed Spices was demonstrated in the digital bazaar. Other products like Expert System on Wheat Crop Management, e-platform for seed spice growers were displayed in the stall raised by IASRI.

### Mushroom Mela

Institute participated in the Mushroom Mela organized at the Directorate of Mushroom Research (DMR), Solan on 10 September 2013. Expert System for Mushroom Crop was launched and demonstrated by Prof. VS Thakur Honourable Vice-Chancellor of Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Solan.

**Trainings Attended**

- Professional Attachment Training at National Institute of Biomedical Genomics, Kalyani, WB during 27 June to 26 September 2013 (Sh. Samarendra Das)

- 21 days Summer School on Decision Support Systems in Agriculture using Quantitative Techniques at NCAP, New Delhi during 02-22 August 2013. (Dr. Yogesh Gautam)

- Professional Attachment Training at Central Marine Fisheries Research Institute, Kochi, Kerala during 19 June-20 September 2013. (Sh. Upendra Kumar Pradhan)

- Training programme on Market Intelligence held at NCAP, New Delhi during 17-18 October 2013. (Dr. RK Paul)

- Training Programme on Quantitative Methods for Policy Analysis Using GAMS held at NCAP, New Delhi during 18-22 November 2013. (Dr. RK Paul)

- Winter School on Development of web application for agricultural information management held during 19 November - 09 December 2013 at IASRI, New Delhi. (Sh. PK Meher and Sh. Arpan Bhowmik)

- Regional training workshop on GIS and Climate Analogue Tools for the PGR Management and Enhanced Use at National Bureau of Plant Genetic Resources (NBPGR), New Delhi in collaboration with Bioversity International during 02-06 December 2013. (Sh. Ankur Biswas)

- Five days training entitled Linux and HPC organized by Hewlett-Packard Education Services during 17–21 February 2014 at IASRI, New Delhi. (Scientist of the Centre for Agricultural Bioinformatics)

- Three days training entitled PBS Professional Training organized by Hewlett-Packard Education Services scheduled during 05-07 March 2014 at IASRI, New Delhi. (All Scientists of Centre for Agricultural Bioinformatics)

**Visit Abroad**

**Dr. UC Sud**

- Visited Bangladesh in connection with the third mission on Dissemination Workshop in Bangladesh during 20-30 April 2013.

- Visited Bangladesh in connection with the project Harmonization and dissemination of unified agricultural production statistics in Bangladesh during 17-26 September 2013.

- Visited Rio-de-Janeiro, Brazil to present a paper entitled District level crop yield estimation under spatial small area model in the Sixth International Conference on Agricultural Statistics (ICAS-VI) held during 23-25 October 2013.

- Visited Paro, Bhutan during 03-15 March 2014 for providing Consultancy on Sampling and Research Methodologies.

**Dr. Hukum Chandra**

- Visited Bangkok, Thailand as Member, Scientific Committee, during 01-04 September 2013 for attending the First Asian International Statistical Institute Satellite Conference on Small Area Estimation, 2013.

- Visited Ethiopia as FAO Consultant during 27 July - 17 August 2013.

**Md. Samir Farooqi**

- Visited USA to attend international training in the area of Bioinformatics and Comparative Genomics from 10 September 2013 to 27 November 2013 at Department of Agronomy, Iowa State University, Ames, Iowa, USA.

**Dr. Susheel Kumar Sarkar**

- Visited Spain to attend training on Integrated Breeding Multi-Year Course (IB-MYC) Year 2 under Generation Challenge Programme-Integrated Breeding Platform (GCP-IBP) during 01-12 July 2013 at Mediterranean Agronomic Institute of Zaragoza (IAMZ) in Zaragoza, Spain.

**Dr. Prachi Misra Sahoo**

- Visited Oman to provide Consultancy to Ministry of Agriculture and Fisheries, Sultanate of Oman during 15 September -10 October 2013.

**Dr. MA Iquebal**

- Visited USA to attend NAIP funded International training in Bioinformatics for three months during 15 September - 15 December 2013 at Iowa State University, Ames, Iowa, USA.

**Dr. Sarika**

- Visited USA to attend NAIP funded International training in Bioinformatics for three months during 15 September - 15 December 2013 at Iowa State University, Ames, Iowa, USA.

**Dr. Sanjeev Panwar**

- Visited Nairobi, Kenya during 06-09 November 2013 as a resource person for taking sessions on Genotype x Environment Analysis in the training on Application of Biometrics and Bioinformatics Tools in Crop Improvement Research.

**Sh. KK Chaturvedi**

- Visited Cornell University, Ithaca, USA during 28 January - 05 April 2014 for receiving training on Bioinformatics under NAIP.

**Dr. DC Mishra**

- Visited USA to attend training in the area of computational biology for three months during 01 July-30 September 2013 at Department of Bioinformatics and Biostatistics, University of Louisville, Louisville, Kentucky, USA.

# 11

## Conferences/Workshops/
## Seminars etc. Organized

**XVII National Conference of Agricultural Research Statisticians**

The Institute organized the XVII National Conference of Agricultural Research Statisticians jointly with NDRI at NDRI, Karnal, Haryana during November 27-28, 2013. Dr. Seema Jaggi from IASRI, New Delhi and Dr. Ravinder Malhotra from NDRI, Karnal were the Organizing Secretaries of the Conference. The Conference was inaugurated by Padam Shri Professor RS Paroda, Chairman, TAAS and Former Director General, ICAR. The Inaugural Function was presided by Dr. AK Srivastava, Director and Vice Chancellor, NDRI, Karnal. Introductory Remarks were given by Dr. VK Gupta, National Professor, ICAR. Conference Remarks were given by Dr. SD Sharma, Vice Chancellor, Dev Sanskriti Vishwavidyalaya, Haridwar. A Keynote Address on "Small Area Estimation - Some

Applications in India" was delivered by Dr. UC Sud, Director of the Institute. A special lecture entitled "Role and Challenges of Agricultural Statisticians - A perspective" was delivered by Dr. AK Srivastava, Former Joint Director of the Institute.

Following six technical sessions and one plenary session, were organized during the conference:

**Technical Session I**

Action taken on the Recommendations of the XVI National Conference of Agricultural Research Statisticians

**Chairman:** Dr. UC Sud, Director IASRI

**Presenter:** Dr. Seema Jaggi

**Rapporteur:** Dr. Prawin Arya

**Technical Session II**

Priorities for Research in Agricultural Statistics: Current Status and Future Challenges

| | |
|---|---|
| **Chairman:** | Dr. VK Gupta, ICAR National Professor |
| **Conveners:** | Dr. Rajender Parsad/ Dr. Ajit |
| **Rapporteurs:** | Dr. Himadri Ghosh/ Dr. Ranjit Kumar Paul |

**Technical Session III**

Priorities for Human Resource Development in Agricultural Statistics and Informatics

| | |
|---|---|
| **Chairman:** | Dr. SD Sharma, Vice Chancellor, DSV Haridwar |
| **Co-Chairman:** | Dr. GR Patil, Joint Director (Academic) NDRI |
| **Conveners:** | Dr. PK Malhotra/ Dr. Seema Jaggi |
| **Rapporteur:** | Dr. Eldho Varghese |

**Technical Session IV**

Priorities for Research in Informatics: Current Status and Future Challenges

| | |
|---|---|
| **Chairman:** | Dr. RC Agrawal, Registrar General, Protection of Plant Varieties and Farmers' Rights Authority, New Delhi |
| **Conveners:** | Dr. Anil Rai/ Dr. AK Sharma |
| **Rapporteurs:** | Smt. Shashi Dahiya/ Sh. Sanjeev Kumar |

**Technical Session V**

Statistics and Informatics Interface with Animal Sciences

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|---|---|
| **Chairman:** | Dr. Arjava Sharma, Director NBAGR Karnal |
| **Conveners:** | Dr. KK Tyagi/ Dr. Ravinder Malhotra |
| **Rapporteurs:** | Dr. Med Ram Verma/ Dr. Anil Kumar |

**Technical Session VI**

Statistics and Informatics Interface with Agricultural Engineering

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|---|---|
| **Chairman:** | Dr. Pitam Chandra, Director CIAE Bhopal |
| **Conveners:** | Dr. KK Tyagi/ Sh. SD Wahi |
| **Rapporteurs:** | Dr. Susheel Kumar Sarkar/ Dr. Kaustav Aditya |

**Plenary Session**

Presentation of Reports by Conveners and Summary of Recommendations

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|---|---|
| **Chief Guest:** | Dr. AK Srivastava, Director NDRI |
| **Chairman:** | Dr. UC Sud, Director IASRI |
| **Conveners:** | Dr. Seema Jaggi/ Dr. Ravinder Malhotra |
| **Rapporteur:** | Dr. AK Gupta |

About 41 research papers were presented by distinguished speakers and about 100 participants from ICAR Institutes/ State Agricultural Universities of different States took part in these deliberations.

**ANNUAL DAY CELEBRATIONS**

The Institute celebrated its 54th Annual Day on 02 July 2013.

➤ Dr. D Rama Rao, National Director, NAIP, ICAR presided over the function and Dr. B Meenakumari, DDG Fisheries, ICAR, New Delhi delivered the Nehru Memorial Lecture on "Fisheries in India: a way forward".

- Nehru Memorial Gold Medal for the year 2010-12 was awarded to Sh. Pratyush Dasgupta and Ms. Anindita Datta M.Sc. (Agricultural Statistics) students and Sh Chandan Kumar Deb, M.Sc. (Computer Application) student.
- The Annual Report of the Institute for the year 2012-13 was also released on this occasion.



## TEACHER'S DAY CELEBRATIONS

The Institute celebrated Teacher's Day on 05 September 2013. On this ocasion, Dr. VK Bhatia, Former Director IASRI was honoured. Dr. Bal BPS Goel, Former Director IASRI presided over the function.





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संस्थान में 02 से 16 सितम्बर 2013 के दौरान हिन्दी पखवाड़े का आयोजन किया गया । दिनांक 02 सितम्बर 2013 को हिन्दी पखवाड़े का उद्घाटन संस्थान के निदेशक (का.), डॉ. उमेश चन्दर सूद जी द्वारा किया गया । हिन्दी पखवाड़े के उद्घाटन के अवसर पर काव्य पाठ का आयोजन किया गया। हिन्दी पखवाड़े के दौरान शिक्षक दिवस, डॉ. दरोगा सिंह स्मृति व्याख्यान के साथ—साथ वैज्ञानिक प्रभागों में सर्वाधिक वैज्ञानिक कार्य हिन्दी में करने के लिए प्रभागीय चल—शील्ड, हिन्दी में शोध—पत्र—पोस्टर—प्रदर्शन—प्रतियोगिता, प्रश्न—मंच, अन्ताक्षरी, हिन्दी वर्तनी प्रतियोगिता, हिन्दीतर कर्मियों के लिए हिन्दी श्रुतलेख एवं शब्दार्थ लेखन प्रतियोगिता आयोजित की गयी । 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 हिन्दी में व्याख्यान दिया जाता है । इस वर्ष यह व्याख्यान भारतीय कृषि सांख्यिकी अनुसंधान संस्थान के पूर्व संयुक्त निदेशक, डॉ. अरुण कुमार श्रीवास्तव जी द्वारा ''कृषि सांख्यिकी में प्रतिचयन पद्धति का विकास एवं क्रियान्वयन — एक परिदृश्य'' विषय पर दिया गया। इस कार्यक्रम की अध्यक्षता राष्ट्रीय कृषि विज्ञान अकादमी के अध्यक्ष, प्रोफेसर राम बदन सिंह

जी द्वारा की गयी । दिनांक 16 सितम्बर 2013 को हिन्दी पखवाड़े का समापन समारोह हुआ । इस अवसर पर हिन्दी पखवाड़े के दौरान आयोजित विभिन्न प्रतियोगिताओं के सफल प्रतियोगियों को पुरस्कृत करने के साथ–साथ अक्टूबर 2012 से जून 2013 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. (Computer Application) and M.Sc. (Bioinformatics). During the period under report, a total of 123 seminar talks were delivered. Out of these, 83 were student seminars, 39 by scientists of the Institute and 01 by Guest Speaker Dr. Sarjinder Singh, Department of Mathematics, Texas A&M University-Kingsville, Kingsville, TX 78363 on 21 June 2013.

**Details of Seminars Delivered**

| Category | Type of seminar | Number |
|---|---|---|
| Guest | | 01 |
| Scientists | Project Completion | 23 |
| | New Project Proposal | 10 |
| | Foreign Training | 05 |
| | General (RFD) | 01 |
| Students | ORW | 16 |
| | Thesis | 18 |
| | Course | 49 |
| **TOTAL** | | **123** |

## SYMPOSIA / WORKSHOPS ORGANISED UNDER VARIOUS PROJECTS

| S.No. | Title | Venue | Date | Sponsored by | Participants |
|---|---|---|---|---|---|
| **Workshops under MIS/FMS** | | | | | |
| 1. | User Training Workshop of MIS/FMS Project MIS (6 Batches) | IARI, New Delhi | 02-09 September & 23-28 September 2013 | NAIP | 168 |
| | Finance | | 09-12 September 2013 | | 33 |
| | HRMS & Self Service HR(2 Batches) | | 16-19 September 2013 | | 47 |
| | Payroll & Pension | | 20-21 September 2013 | | 23 |
| 2. | User Training Workshop of MIS/FMS | NDRI, Karnal | | NAIP | |
| | Payroll & Pension | | 02-03 September 2013 | | 44 |
| | Finance | | 04-05 September 2013 | | 43 |
| | Purchase & Store | | 06-07 September 2013 | | 47 |
| | Project MIS (4 Batches) | | 09-19 September 2013 | | 148 |
| 3. | Sensitization Training/Workshop on MIS/FMS Solution | IASRI, New Delhi | 25 September 2013 | NAIP | 31 |
| 4. | Data Sensitization workshop | IILR, Ranchi | 30 October 2013 | | 47 |
| 5. | User Training Workshops Project MIS – 15 Batches Purchase and Stores | IARI, New Delhi | 01-19 October and 23-24 and 28-29 October, 2013 | NAIP | 47 |
| | HRMS and Self Service HR | | 30-31 October 2013 | | 20 |
| | Payroll and Pension | | 25-26 October 2013 | | 42 |
| | Workshop of MIS/FMS | | 11-12 Nov 2013 | | 360 |

| S.No. | Title | Venue | Date | Sponsored by | Participants |
|---|---|---|---|---|---|
| 6. | User Training Workshops | NAARM, Hyderabad | | NAIP | |
| | HRMS and Self Service HR | | 11-12 November 2013 | | 13 |
| | Payroll and Pension | | 13-14 November 2013 | | 17 |
| | Financials | | 18-21 November 2013 | | 20 |
| | Procurements and Stores | | 22-23 November 2013 | | 17 |
| | Project MIS – 3 Batches | | 25-30 November 2013 | | 83 |
| 7. | User Training Workshops | IASRI, New Delhi | | NAIP | |
| | Financials | | 06-09 November and 11-14 November 2013 | | 41 |
| | HRMS and Self Service HR | | 07-08 November and 22-23 November 2013 | | 26 |
| | Payroll and Pension | | 18-19 November 2013 | | 19 |
| | Project MIS – 8 Batches | | 18-19 November, 25-30 November and 02-12 December 2013 | | 145 |
| | Purchase and Stores | | 20-21 November 2013 | | 14 |
| 8. | User Training Workshops | CIFE, Mumbai | | NAIP | |
| | HRMS and Self Service HR | | 29-30 November 2013 | | 27 |
| | Financials | | 25-28 November 2013 | | 40 |
| | Payroll and Pension | | 02-03 December 2013 | | 31 |
| | Purchase and Stores | | 04-05 December 2013 | | 28 |
| | Project MIS – 3 Batches | | 6-12 December 2013 | | 75 |
| | MIS/FMS solution | | | | |
| | **fgUnh dk;Zky;k** | | | | |
| 9. | आंकडों की प्रोसैसिंग एवं विश्लेषण संयोजकः डॉ (श्रीमती) सिनी वरगीस, डॉ सुशील सरकार व डॉ अनिल कुमार | भा.कृ.सां.अ.स., नई दिल्ली | 25—27 अप्रैल 2013 | भा.कृ.सां.अ.स | 17 |
| 10. | मासिक हिन्दी प्रगति रिर्पोट पर प्रप्रत्र भरने तथा डिस्पैच एवं डायरी रजिस्टरों के रखरखाव संयोजकः श्रीमती उषा जैन | भा.कृ.सां.अ.स., नई दिल्ली | 19 दिसम्बर 2013 | भा.कृ.सां.अ.स | 17 |
| 11. | डेस्कटाप पब्लिशिंग में पेज मेकर का उपयोग संयोजकः श्री नरेश चन्द व श्री पन्ना लाल गुप्ता | भा.कृ.सां.अ.स., नई दिल्ली | 06 जनवरी, 2014 | भा.कृ.सां.अ.स | 25 |
| 12. | कम्प्यूटर पर हिन्दी प्रयोग के लिए यूनिकोड एनकोडिंग का प्रयोग संयोजकः श्री केवल कृष्ण, वरिष्ठ तकनीकी निदेशक, एन.आई.सी., राजभाषा विभाग | भा.कृ.सां.अ.स., नई दिल्ली | 19 फरवरी, 2014 | भा.कृ.सां.अ.स | 32 |

**Other Workshops**

| S.No. | Title | Venue | Date | Sponsored by | Participants |
|---|---|---|---|---|---|
| 13. | Workshop cum Koha Professional Training under "Strengthening of Digital Library and Information Management" (e-GRANTH)<br>Coordinator: Pal Singh | IASRI, New Delhi | 11-12 February 2014 | NAIP | 25 |
| 14. | Sensitization Workshop on Internet Protocol Ver. 6 (IPv6)<br>Coordinators: Sudeep<br>        Mukesh Kumar | NASC Complex, New Delhi | 27 February 2014 | IASRI, New Delhi | 110 |
| 15. | An Interactive Workshop on Experimental Designs. | DWR, Karnal | 15 July 2013 | | |
| 16. | Agropedia 2.0: Capacity Building Workshop for New Partners in collaboration with ICRISAT | IASRI, New Delhi | 15 July 2013 | NAIP | |
| 17. | ICT for Capacity Building in Agricultural Education in India under CAFT | IASRI, New Delhi | 26-27 July 2013 | Education Division, ICAR | |
| 18. | 4th Installation Training-cum-Nodal Officers Workshop under SSCNARS | CIFE, Mumbai | 29-30 August 2013 | NAIP | |
| 19. | 4th Partner's Meet and Installation Training-Cum-Workshop of Nodal Officers Under SSCNARS | IASRI, New Delhi | 17-18 September 2013 | NAIP | |

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# Distinguished Visitors

**INDIAN**

**Shri Sharad Pawar**
Union Minister of Agriculture &
Food Processing Industries
Government of India

**Dr. Charan Das Mahant**
Union Minister of State for
Agriculture and Food Processing Industries
Government of India

**Shri Tariq Anwar**
Union Minister of State for
Agriculture and Food Processing Industries
Government of India

**Dr. S Ayyappan**
Secretary, DARE & Director General
Indian Council of Agricultural Research, New Delhi

**Dr. Bimal K Roy**
Director, Indian Statistical Institute,
203 Barrackpore Trunk Road,
Kolkata-700108 (West Bengal)

**Dr. HS Gupta**
Director, IARI, New Delhi

**Dr. KC Bansal**
Director, NBPGR, New Delhi

**Dr. Saumyadipta Pyne**
PC Mahalanobis Chair Professor,
CR Rao Advanced Institute of Mathematics,
Statistics and Computer Science,
University of Hyderabad Campus,
Prof. CR Rao Road, Hyderabad - 500046,
Andhra Pradesh

**Shri GC Manna**
Deputy Director General (ESD),
Central Statistical Office,
MOS& PI, Sardar Patel Bhawan,
Sansad Marg, New Delhi - 110001

**Dr. Kanchan K Singh**
Assistant Director General (Engg.)
Indian Council of Agricultural Research
Krishi Anusandhan Bhavan - II, Pusa,
New Delhi - 110012

**Dr. Padam Singh**
Former Member,
National Statistical Commission & Head
Research & Evaluation EPOS,
Health Consultants (India) Pvt. Ltd.,
Udyog Vihar, Gurgaon, Haryana

**Prof. Rajesh Kumar Shukla**
Institute for Human Development
New Delhi

**Dr. KV Palanichamy**
Director,
Biostatistics and Statistical Programming,
Biometrics INC Research CDS Services Pvt Ltd
14th Floor, Tower B, Building No.14, DLF Cyber City,
Phase III, Gurgaon-122 002, Haryana, India

**Shri. Ashish Kumar**
Additional Director General,
Ministry of Statistics and Programme Implementation,
Government of India

**Shri Yogender Singh**
Deputy Director General, NASA

**Dr. D Rama Rao**
National Director, NAIP

**Dr. RC Agrawal**
Registrar General, PVPFRA

**Dr. Bal BPS Goel**
Former Director, IASRI, New Delhi

**Dr. SD Sharma**
Vice-Chancellor, Dev Sanskriti Vishwavidyalaya,
Shantikunj-Gayatri Kunj,
Haridwar-249411 (Uttarakhand)

**Dr. VK Bhatia**
Former Director, IASRI, New Delhi

**Dr. AK Srivastava**
Former Joint Director
IASRI, New Delhi

**Prof. RB Singh**
President, National Academy of Agricultural Sciences
NASC Complex, DPS Marg, Pusa
New Delhi

**Dr. NPS Sirohi**
ADG (Engineering), ICAR, New Delhi

**Dr. PS Pandey**
National Coordinator
NAIP, ICAR, New Delhi

**Dr. A Dhandapani**
Principal Scientist, NAARM, Hyderabad

**Shri SK Das**
Department of Animal Husbandry,
Dairying & Fisheries,
Ministry of Agriculture,
Government of India

**Shri Ajith Kumar**
Department of Animal Husbandry,
Dairying & Fisheries,
Ministry of Agriculture,
Government of India

**Shri Manoj Kumar**
Department of Animal Husbandry,
Dairying & Fisheries,
Ministry of Agriculture,
Government of India

**Dr. (Smt.) Ravinder Kaur**
Project Director,
Water Technology Centre
IARI, Pusa, New Delhi

**Dr. Suresh Pal**
Head, Division of Agricultural Economics,
IARI, Pusa, New Delhi

**Dr. Niranjan Prasad**
Division of Processing & Product Development,
IINRG, Ranchi

**FOREIGN**

**Dr. Sarjinder Singh**
Department of Mathematics,
Texas A&M University-Kingsville, Kingsville, TX 78363

**Prof. Martin Bauer**
London School of Economics
St Clements Building
Houghton Street, London

# Special Infrastructural Facilities Developed

**ASHOKA: First Supercomputing Hub for Indian Agricultural Research (Milestone of Agricultural Research)**

The first supercomputing hub for Indian Agriculture ASHOKA (Advanced Super-computing Hub for OMICS Knowledge in Agriculture) has been established at Centre for Agricultural Bioinformatics (CABin), IASRI. This facility was dedicated to the nation by the honourable Agriculture Minister Sh. Sharad Pawar. The facility is set up in a state-of-art data centre and two super-computers of this hub are listed at rank 11 and 24 in the list of top super-computers of India http://topsupercomputers india.iisc.ernet.in/jsps/june2013/index.html.

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, (iii) 16 nodes windows cluster with one master, (ii) 16 nodes GPU cluster with one master with192 CPUs + 8192 GPUs and (iv) SMP based machine with 1.5 TB RAM. Also, this hub has approximately 1.5 Peta Byte storage divided into three different types of storage architecture i.e. Network Attached Storage (NAS), Parallel File System (PFS) and Archival. This hub also consists of super-computing systems (16 node Linux cluster with one master and 40 TB storage) at National Bureaux of Plant Genetic Resources (NBPGR) New Delhi, National Bureaux of Animal Genetic Resources (NBAGR) Karnal, National Bureaux of Fish Genetic Resources (NBFGR) Lucknow, National Bureaux of Agriculturally Important Microbes (NBAIM) Mau and National Bureaux of Agriculturally Important Insects (NBAII), Bangalore which forms a National Agricultural Bioinformatics Grid in the country. Number of computational biology and agricultural bioinformatics software/workflow/pipelines along with National Biological Computing Portal are in the process of development, which will provide seamless access to these biological computing resources to the biological researchers across the country.

The software procured under this project are CLC Bio, Discovery Studio and SAS Modules of Text Mining and Data Management & Integration.



HPC Infrastructure at NBFGR, Lucknow



HPC Infrastructure at NBPGR, New Delhi



HPC Infrastructure at NBAII, Bangalore



HPC Infrastructure at NBAGR, Karnal



HPC Infrastructure at NBAIM, Mau

**Management Information System (MIS) including Financial Management System (FMS) in ICAR funded by NAIP**

ICAR-ERP system has been designed and implemented at IASRI to bring transparency and standardization in process. ICT Infrastructure and Unified Messaging & Web Hosting facilities have been created at IASRI. The facilities will provide email solution for all employees of ICAR with features of unified messaging at desktop of users. Web hosting environment will facilitate use of website/applications developed by ICAR institutes.

- **Features of Unified Communication**
  - Messaging (Webmail and POP)
  - Phonebook
  - Calendar
  - Schedule meetings
  - Chat
  - Presence
  - Web Conferencing
  - Video Conferencing including Presentation Sharing

- **Features of ICAR-ERP**
  - Financial Management: General ledger, Accounts Payable, Accounts Receivable, Cash Management, Fixed Assets Management, Budget Management and Grants.
  - Project Management: Project Information, Costing, Project Documents, Contract Management and Collaboration of Project documents.
  - Material Management: Purchase and Inventory Management.
  - Human Resource: Employee information, HR Policies, Leave Management, Performance and Appraisal System.
  - Payroll System: Salary, GPF, Pension Payment, Retirement Benefit Calculation and Income Tax Calculation solutions for ICAR employees.

- **Computing Infrastructure**
  - 448 Core Computing for unified messaging
  - 150 TB storage for unified messaging
  - Active Directory for unified messaging

- IBM Power 700 series RISC Servers (seven) for ICAR-ERP application
- 32 TB Storage Area Network (SAN) for ICAR-ERP application
- Automated Tape Library for ICAR-ERP application
- Firewall

- **Software (Unified Messaging and ICAR-ERP system)**
  - Microsoft OS
  - Linux OS
  - Microsoft SQL DBMS
  - MySQL
  - Microsoft Exchange 2013
  - Microsoft Lync 2013
  - Virtualization
  - Unix based AIX Operating System
  - Oracle Database 11g
  - Oracle Fusion Middleware 12C
  - Oracle ERP Release 12.1.3
    - o Oracle Financials
    - o Oracle Grants
    - o Oracle Projects
    - o Oracle Purchase & Inventory
    - o Oracle Human Resources (HR)
    - o Oracle Payroll

- **MIS/FMS Lab and Video Conferencing Lab**
  - A lab has been created in the computer division to facilitate training. Lab 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. This has rooms and labs (with centralized AC) for scientific/technical and administrative staff of division. Auditorium has been renovated for conducting seminars/ meetings/ IRC/ Project discussions/ lectures and scientific discussions.

- **Networking**

  - 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.

    Computing facilities have been strengthened by procuring desktop computers, printers and related peripherals.



Network Operating Center –
Second Floor Computer Center Building



Network Operating Center –
Ground Floor Computer Center Building



Auditorium



ICAR-ERP Production Hardware

- **Digital Repository**

  - Data has been digitized for IASRI employees, pensioners, asset and payroll and are being used for implementation of ICAR-ERP system.

**Phenomics of moisture deficit and low temperature stress tolerance in rice project funded by NFBSFARA**

- Application Server (24 Cores, 64 GB RAM)
- Database Server (8 core, 64GB RAM)
- 15TB of storage



Application Server

# 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: 05.04.2006-31.03.2016

### Institute Funded

2. Development of innovative convenience food as protein supplement. (Collaboration with IARI, New Delhi association w.e.f. 26.02.2010). (CIP0912)
   IARI: SK Jha, Shruti Sethi, RK Pal, Abhijit Kar, VR Sagar, Charanjit Kaur, DVK Samuel and Amar Singh IASRI: Krishan Lal: 24.10.2009–31.03.2014

3. Weed assessment and management in the crops and cropping systems. (Collaboration with IARI, New Delhi w.e.f. 29.12.2010). (CIP1011)
   IARI: Rajvir Sharma, TK Das, Jitender Kumar, Pankaj, Livleen Shukla, Sangeeta Paul, Renu Pandey and Mahesh Chand Meena, IASRI: Amrit Kumar Paul: 01.04.2009–31.03.2014

4. Planning, designing and analysis of data relating to experiments for AICRP on long-term fertilizer experiments. (SIX1206)
   Krishan Lal, BN Mandal (from 01.10.2012 to 21.09.2013) and LM Bhar (w.e.f. 01.10.2013): 01.04.2012–31.03.2017

5. Planning, designing and analysis of 'On Farm' research experiments planned under PDFSR. (SIX1207)
   NK Sharma and Sukanta Dash (w.e.f. 01.10.2012): 01.04.2012–31.03.2017

6. Information system for designed experiments. (SIX1208)
   OP Khanduri, DK Sehgal (till 31.08.2012), Soumen Pal (till 30.09.2012), Shashi Dahiya and Susheel Kumar Sarkar (w.e.f. 01.10.2012): 01.04.2012–31.03.2017

7. Planning, designing and analysis of experiments planned 'On Stations' under PDFSR. (SIX1209)
   Anil Kumar and Eldho Varghese (w.e.f. 01.10.2102): 01.04.2012–31.03.2017

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

9. Livelihood and nutritional security of tribal dominated areas through integrated farming system and technology models. (NAIP-Component 3-IARI) (CIP1118) (Association of IASRI w.e.f 01.08.2011)
   MPUA&T, Udaipur: IJ Mathur, IARI: JP Sharma, IASRI: Anil Kumar: 11.10.2007- 31.03.2014

### Outside Funded

10. 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: 01.10.2011–30.09.2014

11. 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, Archna Verma, AP Ruhil and SV Singh, IASRI: Anil Kumar: 01.02.2013-31.01.2016

### Completed

### Institute Funded

12. Mating-environmental designs under two-way blocking setup. (SIX1202)

   Eldho Varghese and Cini Varghese: 15.03.2012–30.09.2013

13. Main effects linear trend-free multi-level factorial experiments. (SIX1205)

   Susheel Kumar Sarkar, Krishan Lal and VK Gupta: 27.03.2012–28.02.2014

14. Row-column designs for factorial experiments in two rows. (AGENIASRISIL201200100001)

   Sukanta Dash, Rajender Parsad and VK Gupta: 04.10.2012–31.03.2014

### New Initiated

### Institute Funded

15. 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

16. 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, AICRP on VC, Varanasi: B. Singh and T. Choubey: 05.02.2014-05.02.2015

## FORECASTING, MODELLING AND SIMULATION TECHNIQUES IN BIOLOGICAL AND ECONOMIC PHENOMENA

### On-going

### Institute Funded

17. 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

18. Pest and disease dynamics vis-a-vis climatic change under National Initiative on Climate Resilient Agriculture (NICRA) (Collaboration with NCIPM, New Delhi). (COP1105)

   NCIPM: S Vennila, IASRI: Amrender Kumar and KN Singh (w.e.f. 01.10.2012): 01.06.2011–31.03.2017

   *The project is shifted to IARI along with Co-PI Dr. Amrender Kumar.

19. Enhancing resilience of agriculture to climate change through technologies, institutions and policies (Funded by National Initiative on Climate Resilient Agriculture (NICRA)). (COP1112)

   NCAP: Pratap Singh Birthal, Suresh A Kurup and Shiv Kumar, NAARM, Hyderabad: GP Reddy, IASRI: Ranjit Kumar Paul: 29.08.2011– 31.03.2014

### Completed

### Institute Funded

20. Forecasting models using functional data analysis and nonlinear support vector regression techniques. (SIX1117)

   Mir Asif Iquebal and Prajneshu (till 31.07.2013): 04.10.2011–12.09.2013

21. Development of weather based crop yield forecasting models using Generalized Autoregressive Conditional Heteroscedastic (GARCH) and wavelet techniques. (SIX1120)

   Ranjit Kumar Paul, Prajneshu and Himadri Ghosh: 11.10.2011–30.06.2013

22. An econometric study of water markets in canal command area of North-Western Rajasthan. (SIX1122)

DR Singh, Sivaramane N (till 27.03.2012), Prawin Arya and SP Bhardwaj (w.e.f. 28.03.2012): 04.11.2011–31.07.2013

23. Weather based yield forecast for rice and wheat using non-linear regression techniques. (SIX1129)

Sanjeev Panwar and N Okendro Singh (till 28.02.2013): 26.12.2011–30.04.2013

24. Development of forecasting methodology for fish production from ponds of upland region (Collaboration with DCFR, Bhimtal). (CIL1109)

IASRI: N Okendro Singh (till 28.02.2013) and Sanjeev Panwar (w.e.f. 23.09.2011 as Co-PI and w.e.f. 01.03.2013 as PI), DCFR, Bhimtal: Prem Kumar (w.e.f. 23.09.2011): 20.08.2011–27.08.2013

25. Weather based forewarning of mango pests (Collaboration with CISH, Lucknow). (CIL1005)

IASRI: Ranjana Agrawal, CISH, Lucknow: Rakesh Chandra, G Pandey and AK Misra, RFRS, Vengurle: BR Salvi, MB Dalvi and AY Munj, AES, Paria: NI Shah, Hemant Sharma and GB Kalariya, BCKV, Mohanpur: SK Ray and A Samanta, BAC, Sabour: Rajesh Kumar, SN Ray and Mithelesh Kumar, FRS Sangareddy: A Bhagwan, B Mahindar and D Anitha Kumari: 01.04.2010-31.07.2013

26. A study of stochastic volatility models through particle filtering. (SIX1201)

Bishal Gurung and Himadri Ghosh: 02.02.2012–30.06.2013

## New Initiated

### Institute Funded

27. 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

28. A study on STAR and SV families of nonlinear time-series models for describing cyclicity and volatility in Agriculture. (AGENIASRISIL20130080009)

Bishal Gurung, Himadri Ghosh and Ranjit Kumar Paul: 21.05.2013-30.04.2015

29. Development of statistical approach for prediction of eukaryotic splice sites. (AGENIASRISIL201301300014)

Prabina Kumar Meher, SD Wahi and AR Rao: 03.09.2013-02.09.2015

30. Estimation of heritability under correlated errors. (AGENIASRISIL201400100020)

Amrit Kumar Paul and SD Wahi: 04.01.2014-03.01.2016

### Outside Funded

31. Network project on market intelligence. Funded by ICAR, DARE, Ministry of Agriculture, New Delhi (AGENIASRICOP201400300022)

NCAP: Raka Saxena, IASRI: Ranjit Kumar Paul: 13.02.2014-31.03.2017

32. National Information System for Pest Management (BT Cotton). (AGENIASRISOL201301500016) Under the Mini Mission-II of technology Mission on cotton project of Deptt of Agriculture and cooperation, Ministry of Agriculture, GOI.

NCIPM: RK Tanwar, IASRI: Prawin Arya: 08.07.2013-31.03.2014

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

### On-going

### Institute Funded

33. Small area estimation for skewed data. (AGENIASRISIL201300100002)

Hukum Chandra, UC Sud and Kaustav Aditya: 19.01.2013-31.12.2014

34. Farm power machinery use protocol and management for sustainable crop production (Collaboration with Division of Agricultural Engineering, IARI, New Delhi association w.e.f. 08.02.2010) (CIP0906)

IARI: Indra Mani, Dipankar De, MS Kalra, JK Singh, Adarsh Kumar, PK Sahoo, PK Sharma, Alka Singh, JP Sinha (w.e.f. 25.02.2011) and Satish Lande (w.e.f. 25.02.2011), IASRI: Tauqueer Ahmad and Sangeeta Ahuja (w.e.f. 01.04.2013): 01.04.2009–31.03.2014

### Outside Funded

35.  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 (till 01.12.2013) and RK Vishwakarma  IASRI: Tauqueer Ahmad, Anil Rai and Prachi Mishra Sahoo: 01.02.2012–31.01.2015

### Completed

### Institute Funded

36.  Study of sample sizes for estimation of area and production of food grain crops (SIX1125)

     KK Tyagi, AK Gupta, VK Jain and Kaustav Aditya : 14.11.2011–31.07.2013

37.  On small area inference using survey weights. (SIX1107)

     IASRI: Hukum Chandra and VK Jain, DWSR, Jabalpur: Yogita Gharde (w.e.f. 12.10.2012): 06.08.2011–31.08.2013

38.  Spatial non-stationarity in small area estimation under area level model. (SIX1114)

     Hukum Chandra, UC Sud and Yogita Gharde (till 31.03.2012): 01.10.2011–20.09.2013

39.  Study to develop methodology for crop acreage estimation under cloud cover in the satellite imageries. (SIX1119)

     Prachi Misra Sahoo, Tauqueer Ahmad, KN Singh and AK Gupta: 10.10.2011–13.09.2013

40.  A study on calibration estimators of finite population total for two stage sampling design. (SIX1211)

     Kaustav Aditya, UC Sud, Hukum Chandra and VK Jain (till 31.10.2013): 01.04.2012-18.03.2014

### New Initiated

### Outside Funded

41.  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, Hukum Chandra, Tauqueer Ahmad, VK Jain, Kaustav Aditya, Prachi Misra Sahoo and Ankur Biswas: 01.07.2013-30.06.2015

42.  Development of innovative approches for small area estimation of crop yield, socio-economic and food insecurity parameters-under ICAR's Lal Bahadur Shashtri Young Scientist award- 2012. (AGENIASRISOL201301800019)

     Hukum Chandra and Kaustav Aditya: 09.12.2013-08.12.2016

43.  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

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

### On-going

### Institute Funded

44.  Parallelized workflows for gene prediction, phylogenetic analysis and primer designing. (SIX1219)

     SB Lal, Anu Sharma and Sarika: 28.08.2012–31.07.2014

45.  In silico identification of abiotic stress (Salinity) responsive transcription factor and their cis-regulatory elements in grapes (Vitis venifera). (Collaboration with NRC Grapes, Pune) (CIP1213)

     NRC Grapes, Pune: Anuradha Upadhyay and Ajay Kumar Upadhyay, IASRI: Sarika: 01.01.2012–31.12.2013

**Outside Funded**

46. 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: 29.09.2008–28.01.2014

47. 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: 04.05.2009–31.03.2014

48. 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: 15.02.2011–14.02.2016

49. Buffalo genome information resource (Funded by DBT) (Collaboration with NDRI, Karnal). (COP1215)

   NDRI, Karnal: Sachinandan De, IASRI: AR Rao: 26.03.2012–25.03.2014

## Completed

### Institute Funded

50. Study of synonymous codon usage and its relation with gene expressivity in genomes of halophilic bacteria (Collaboration with NBAIM, Mau). (CIL1108)

   IASRI: Samir Farooqi and DC Mishra, NBAIM, Mau: DP Singh and KK Meena: 01.08.2011–15.04.2013

51. Analysis and determination of antimicrobial peptides: A machine learning approach. (SIX1121)

   Sarika and Mir Asif Iquebal: 01.11.2011–31.03.2014

52. Genomics and molecular markers in crop plants (Collaboration with NRCPB, New Delhi association w.e.f. 28.10.2010) (Sub-project 4: Development of new genomic and EST resources and functional genomics of thermo tolerance in mandate crops). (CIP1010)

   NRCPB: NK Singh and Kishore Gaikwad, IASRI: AR Rao: 01.04.2009–31.03.2012

53. Algorithm for gene classification based on gene expression data. (SIX1210)

   DC Mishra and Sanjeev Kumar: 01.04.2012–31.03.2014

54. Study on robustness of sequential testing procedures for some distributions used in agricultural pest control. (SIX1212)

   Wasi Alam: 01.04.2012–04.03.2014

## New Initiated

### Institute Funded

55. Methodology for protein structure comparison and its web implementation. (AGENIASRISIL201300600007)

   Sudhir Srivastava, MNV Prasad Gajula and DC Mishra: 18.04.13-17.04.15

56. 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

57. 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

58. 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, N K Singh and Vandana Rai, DRR: D Subramanyam, P Senguttuvel, DKMA: Himanshu, CDAC: Rajendra Joshi: 01.04.2013-31.03.2016

59.     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

## DEVELOPMENT OF INFORMATICS IN AGRICULTURAL RESEARCH

### On-going

### Institute Funded

60.     Project information and management system of ICAR (PIMS-ICAR). (SIX0901)

RC Goyal (till 30.06.2013), Pal Singh, PK Malhotra, Sudeep and Alka Arora: 01.01.2009–31.03.2014

61.     Management system for post graduate education - II. (SIX1218)

Sudeep, PK Malhotra, RC Goyal (till 30.06.2013), Yogesh Gautam and Pal Singh (w.e.f. 01.10.2013): 01.04.2012–31.03.2017

62.     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

63.     Development of web based mushroom expert system. (CIP1110)

DMR, Solan: Mahantesh Shirur (till 30.09.2012), K Manikandan (w.e.f. 01.10.2012), 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

64.     Strengthening and refinement of maize AgriDaksh. (CIP1113)

DMR: Virendra Kumar Yadav, KP Singh, 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): 01.04.2011–31.03.2016

### Outside Funded

65.     Strengthening Statistical Computing for NARS (NAIP Component I: Consortium Leader). (COL0908)

Director (IASRI), Rajender Parsad, PK Malhotra (till 31.03.2011), VK Mahajan (till 31.03.2011), Seema Jaggi, Samir Farooqui, Ramasubramanian V (till 31.07.2013), LM Bhar, AK Paul and N Sivaramane (till 27.03. 2012): 20.04.2009–31.03.2014

66.     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

67.     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

68. 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

## Completed

## Institute Funded

69. Exploration of central data warehouse for knowledge discovery. (SIX1127)

 Anshu Bharadwaj, SN Islam and DR Singh: 09.12.2011–05.09.2013

70. Web based software for codon usage analysis for gene expression identification. (SIX1204)

 Anu Sharma, SB Lal and DC Mishra: 16.03.2012-24.05.2013

71. Development of scientific monitoring system and database design for the HYPM. (SIX1216)

 RC Goyal (till 30.06.2013), Sudeep and Alka Arora: 01.04.2012–30.06.2013

72. Development of methodology for estimation of compound growth rate and its web-based solution.(SIX1102)

 Soumen Pal (till 30.09.2012), Himadri Ghosh and Prajneshu (till 31.07.2013): 25.04.2011–17.02.2014

73. ePlatform for seed spice growers. (CIL1128)

 IASRI: SN Islam, Shashi Dahiya, Anshu Bharadwaj and SP Bhardwaj, NRCSS, Ajmer: RS Mehta, MK Vishal, MA Khan, Gopal Lal (w.e.f. 13.02.2013), Ravinder Singh (w.e.f. 13.02.2013), JK Ranjan (w.e.f. 13.02.2013), RK Solanki (w.e.f. 13.02.2013) and SS Rathore (w.e.f. 13.02.2013):17.12.2011–15.11.2013

## New Initiated

## Outside Funded

74. E-publishing and knowledge system in agricultural research under the component-1 of NAIP (Association of IASRI w.e.f 11.09.2013) (AGENIASRICOP201301700018)

 DKMA: Himanshu,  IASRI: Anshu Bhardwaj: 01.11.2008 - 31.03.2014

75. Refinement of livestock feed resources and development of dynamic database information system. (Collaboration with NIANP, Adugodi, Banglore) (AGENIASRICIP201400400023)

 NIANP, Bangalore: S Jash and S Anandan, IASRI: UB Angadi: 01.07.2010–31.12.2014

76. 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

77. Strengthening of digital library and information management under NARS (e-GRANTH). Funded by NAIP (AGENIASRISOL201301100012)

 Pal Singh, Praveen Saxena,  G Kaur,  SPS Hans: 09.05.2013-31.03.2014

# VARIOUS COMMITTEES

## Consultancy Processing Cell (CPC)

| | | |
|---|---|---|
| 1. | Dr. Prajneshu, HD (Statistical Genetics) | Chairman (till 31.07.2013) |
| 2. | Dr. Rajender Parsad, HD (Design of Experiments) | Chairman (w.e.f. 01.08.2013) |
| | | Member (till 31.07.2013) |
| 3. | Dr. PK Malhotra, HD (Computer Application) | Member |
| 4. | Dr. Seema Jaggi, Principal Scientist and Incharge, PME Cell | Member |
| 5. | Dr. Tauqueer Ahmad, Principal Scientist | Member (w.e.f. 01.08.2013) |
| 6. | Head of Office (Ex-Officio) | Member |
| 7. | Finance and Accounts Officer (Ex-Officio) | Member |
| 8. | Sh. PP Singh, Chief Technical Officer | Member-Secretary |

## Institute Technology Management Committee (ITMC)

| | | |
|---|---|---|
| 1. | Dr. UC Sud, Director (A) | Chairman |
| 2. | Dr. PK Malhotra, Professor (Computer Application) | Member |
| 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 |
| 6. | Dr. Rajender Parsad, HD (Design of Experiments) (Incharge, ITMU) | Member–Secretary |

## Institute Technology Management Unit (ITMU)

| | | |
|---|---|---|
| 1. | Dr. Rajender Parsad, HD (Design of Experiments) 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 |
| 3. | Dr. KK Tyagi, Principal Scientist | RFD Co-Nodal Officer |
| 4. | All Head of Divisions | Member |
| 5. | Incharge, PME Cell | Member |
| 6. | Professor (Agricultural Statistics) | Member |
| 7. | Professor (Computer Application) | Member |
| 8. | Professor (Bioinformatics) | Member |
| 9. | Chief Administrative Officer | Member |
| 10. | Senior Finance & Accounts Officer | Member |

### RFD Cell of the Institute

1. Dr. UC Sud, Director (A),                             Chairman
   HD (Sample Surveys) & RFD Nodal Officer
2. Sh. VK Jain                                          Member (31.10.2013)
3. Dr. AK Mogha                                         Member
4. Sh. Bikram Singh                                     Member

### Institute Deputation Committee

1. Director                                             Chairman
2. All Head 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. HD (Design of Experiments)                           Member
3. HD (Statistical Genetics)                            Member
4. HD (Forecasting and Agricultural Systems Modelling)  Member
5. HD (Sample Surveys)                                  Member
6. HD (Centre for Agricultural Bioinformatics)          Member
7. HD (Computer Application)                            Member
8. Incharge, PME Cell                                   Member Secretary

### Institute Joint Staff Council

**Official Side Members**

1. Dr. UC Sud, Director (A)                             Chairman
2. Dr. AK Chaubey, Head (CA)                            Member
3. Dr. KK Tyagi, Principal Scientist                   Member
4. Sh. SD Wahi, Principal Scientist                    Member
5. Dr. Seema Jaggi, Incharge (PME)                     Member
6. Sh. AP Sharma, Sr. F&AO                             Member
7. Smt. Poonam Singh                                   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 (A)                                    Chairman
2. Dr. (Smt.) Ranjana Agrawal, Principal Scientist            Member (till 31.07.2013)
3. Sh.  AP Sharma, Sr. F&AO                                   Member
4. Smt. Poonam Singh, Head of Office                          Member
5. Sh. Chander Vallabh, AAO                                   Member Secretary

### Staff Side Members
1. Sh. Pal Singh, Scientist (SS)                              Member Scientific Group
2. Sh. Satya Pal Singh, Sr. Technical Officer                 Member Technical Group
3. Sh. Basant Kumar, UDC                                      Member Administrative Group
4. Sh. Mohan Singh, SSS                                       Member Skilled Supporting Staff Group

## ICAR Staff Welfare Fund Scheme
1. Dr. UC Sud, Director, Welfare Officer  & Chairman
2. Dr. Seema Jaggi, Principal Scientist and Female Member
3. Dr. KK Tyagi, Principal Scientist and Member
4. Sh. AP Sharma, Sr. F&AO and Member
5. Smt. Poonam Singh, Head of Office and Member (w.e.f. 24.12.2013)
6. Sh. KB Sharma, Secretary, IJSC(SS) and Member
7. Sh. Mahender Pandit, Member IGC and Member
8. Sh. Chander Vallabh, AAO and Member Secretary

## Women Cell
1. Dr. Ranjana Agrawal, Principal Scientist                   Chairperson (till 31.07.2013)
2. Dr. Seema Jaggi, Principal Scientist                       Chairperson (w.e.f. 01.08.2013)
                                                              Member (till 31.07.2013)
3. Smt. Poonam Singh, AO                                      Member (w.e.f. 24.12.2013)
4. Ms. Vijay Bindal, Chief Technical Officer                  Member
5. Smt. Suman Khanna, Stenographer                            Member
6. Smt. Sushma Gupta, AAO                                     Convener

## Canteen Committee
1. Head of Office                                             Chairman
2. Dr. UC Sud, HD Director (A), (Sample Surveys) & Welfare Officer   Member
3. Sh. AP Sharma, Sr. F&AO                                    Member
4. AAO (Admn. II)                                            Member
5. Smt. Savita Wadhwa                                         Lady Member
6. Sh. SK Sublania, MTO (Chief Technical Officer)            Member Secretary

## International Training Hostel (ITH)/Panse Guest House
Sh. RK Koli, AAO is the Incharge and Sh. Sunil Kumar is the Caretaker of the Guest Houses. A total of 1354 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 1981 guests stayed at Panse Guest House during the period under report.

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## Hostel Executive Committee

| | | |
|---|---|---|
| 1. | Warden | Dr. UC Sud |
| 2. | Prefect | Arvind Kumar |
| 3. | Mess Secretary | Achal Lama |
| 4. | Cashier | Shwetank Lall |
| 5. | Cultural Secretary | Pramod Kumar Maurya |
| 6. | Assistant Cultural Secretary | Sarvana Kumar |
| 7. | Maintenance Secretary | Satish Kumar Yadav |
| 8. | Assistant Maintenance Secretary | Prathesh P. Gopinath, Sushil Kumar |
| 9. | Health Secretary | Amit Kairi Somanna |
| 10. | Sports Secretary | Sourav Guha |
| 11. | Assistant Sports Secretary | Nitin Varshney |
| 12. | Common Room Secretary | Murari Kumar, Rahul Banerjee |
| 13. | Gym Secretary | Neeraj Budhlakoti |
| 14. | Computer Lab Secretary | Lincoln Saha |
| 15. | Communication Secretary | Himadri Shekhar Roy, Pankaj Das |
| 16. | Auditors | Pradip Basak, Sunil Kumar Yadav Md. Harun, Rajeev Ranjan |
| 17. | Dining Hall committee | Chandan Kumar Deb, Prakash Kumar, Raju Kumar |
| 18. | Warden's Nominee | Kader Ali Sarkar |

## Institute Recreation Club

| | | |
|---|---|---|
| 1. | Dr. UC Sud, Director (A) | President |
| 2. | Sh. OP Khanduri, Senior Scientist | Vice President |
| 3. | Sh. RS Tomar, Assistant Chief Technical Officer | Secretary |
| 4. | Sh. Sunil Bhatia, Technical Officer | Treasurer |
| 5. | Sh. Raj Kumar Verma, UDC | Member |
| 6. | Sh. Mukesh Kumar, LDC | Member |
| 7. | Sh. Sunil Kumar-I, LDC | Member |
| 8. | Smt. Vijay Laxmi Murthy, PA | Lady Member |

## Institute Sports Committee

| | | |
|---|---|---|
| 1. | Dr. UC Sud, Director (A) | President |
| 2. | Dr. KN Singh, HD, Forecasting and Agricultural Systems Modelling | Vice President |
| 3. | Sh. OP Khanduri, Senior Scientist | Vice President |
| 4. | Sh. AP Sharma, Sr. F&AO | Member |
| 5. | Smt. Poonam Singh, Head of Office | 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 Murthi, PA | Lady Member |

**IASRI Employees Co-operative Thrift and Credit Society Limited**

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| 1. Dr. UC Sud, Director (A) | Patron |
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| 3. Ms. Vijay Bindal | Vice-President |
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| 5. Sh. Pradeep Kumar | Treasurer |
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| 10. Sh. Ram Bhool | Member |
| 11. Sh. NK Sharma | Member |
| 12. Sh. Parbhu Dayal | Member |
| 13. Sh. Rajnath | Member |

# IASRI PERSONNEL

**Director**
Dr. UC Sud (A)

**National Professor** (on Strength of ICAR)
Dr. VK Gupta

**Head, Division of Design of Experiments**
Dr. Rajender Parsad

**Head, Division of Sample Surveys**
Dr. UC Sud

**Head, Division of Statistical Genetics**
Dr. Prajneshu (till 31.07.2013)
Sh. SD Wahi (A) (w.e.f. 01.08.2013)

**Head, Centre for Agricultural Bioinformatics**
Dr. Anil Rai

**Head, Division of Forecasting & Agricultural Systems Modeling**
Dr. KN Singh

**Head, Division of Computer Application**
Dr. AK Chaubey

**Professor (Agricultural Statistics)**
Dr. Rajender Parsad

**Professor (Computer Application)**
Dr. PK Malhotra

**Professor (Bioinformatics)**
Dr. Prajneshu (till 31.07.2013)
Dr. Anil Rai (w.e.f. 01.08.2013)

**Warden, Sukhatme Hostel**
Dr. (Smt.) Ranjana Agrawal (till 31.07.2013)
Dr. UC Sud (w.e.f. 01.08.2013)

**Incharge, Prioritization, Monitoring & Evaluation (PME) Cell**
Dr. Seema Jaggi

**Vigilance Officer**
Dr. UC Sud

**Transparency Officer & Nodal Officer, RTI**
Dr. Prajneshu (till 31.07.2013)
Sh. SD Wahi (w.e.f. 30.10.2013)

**Welfare Officer**
Dr. UC Sud

**Incharge, National Agricultural Science Museum**
Dr. (Smt.) Sushila Kaul

**Chief Administrative Officer**
Sh. KPS Gautam (till 22.11.2013)

**Administrative Officer**
Smt. Poonam Singh (w.e.f. 16.08.2013)

**Sr. Finance and Accounts Officer**
Sh. AP Sharma

**Librarian**
Sh. Praveen Kumar Saxena

**Public Information Officer**
Sh. KPS Gautam (till 22.11.2013)
Smt. Poonam Singh (w.e.f. 04.01.2014)

# NATIONAL AGRICULTURAL SCIENCE MUSEUM (NASM)

National Agricultural Science Museum (NASM) was conceived by the ICAR and executed by the National Council of Science Museums, Ministry of Culture, Government of India during 2004. The responsibility of up-keep and maintenance of NASM rests with Indian Agricultural Statistics Research Institute (ICAR), Pusa, New Delhi. NASM is situated at NASC Complex, DPS Marg, Opposite Dasghara Village, Pusa Campus, New Delhi. The Museum is looked after by a Central Management Committee constituted at the ICAR Headquarter level and is composed of

| | |
|---|---|
| Dr. MM Pandey, DDG (Engg.) (till 30.6.2013) | Chairman |
| Dr. DR Rao, DDG (Engg.) (1.7.13 to 10.7.13) | Chairman |
| Dr. NS Rathore, DDG (Engg.) (11.7.2013 to 24.9.2013) | Chairman |
| Dr. DR Rao, DDG (Engg.) (w.e.f. 25.9.13) | Chairman |
| Dr. NPS Sirohi, ADG (Engg.) (till 31.7.2013) | Member |
| Dr. AK Vasisht, Assistant Director General (PIM, ICAR) | Member |
| Dr. RC Agrawal, Registrar General, PPV&FR | Member |
| Dr. UC Sud, Director (A), IASRI | Member |
| Dr. S Ganesan, Principal Scientist (Engg.) | Member |
| Dr. Rameshwar Singh, Project Director, DKMA | Member |
| Dr. Sushila Kaul, Incharge, NASM | Member Secretary |

Under the guidance of this Committee, day-to-day activities of the Museum relating to up-keep and maintenance are looked after by Dr. Sushila Kaul, Scientist In-charge NASM along with technical 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–the weekly holiday. It is not closed even for lunch break. 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. The museum was highlighted during the Pusa Krishi Vigyan Mela at Indian Agricultural Research Institute, New Delhi during 26-28 February 2014.

**Distinguished Visitors**

In all, 20582 visitors visited the Museum during the year 2013-14 and 2675 tickets were sold. Students from 35 schools of Delhi/NCR visited NASM. Students from Universities of 16 states and farmers from 18 states of India visited NASM. Trainees of different trainings conducted by ICAR Institutes and many important delegations also visited NASM. Visitors found NASM very informative and they gained vital knowledge from the exhibits displayed in the Museum.