



IASRI ANNUAL REPORT

2012-13



INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE
(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)
LIBRARY AVENUE, PUSA, NEW DELHI - 110 012

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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

भारतीय अणुसंश्लेषण अनुसंधान संस्थान (ICCR)

Preface



It is a matter of great pleasure for me in bringing out the Annual Report 2012-13 of the Indian Agricultural Statistics Research Institute (IASRI). The Institute has been using 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 made some outstanding and useful contributions to the research in the field of Design of

Experiments, Statistical Genetics, Bioinformatics, Forecasting Techniques, Statistical Modelling, Sample Surveys, Econometrics, Computer Application and Software Development. The Institute has conducted basic and original research on many topics of interest. The report highlights some of the glimpses of 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.

To fulfil the objectives and mandate of the Institute, research was carried out under 68 research projects in the Institute (01 National Professor Scheme, 38 Institute funded, 16 funded by other outside agencies and 13 in collaboration with other Institutions). A total of 11 projects have been completed and 19 new projects have been initiated.

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 development of Financial Management System/ Management Information System for ICAR. Linkages have been established with all NARS organizations for strengthening statistical computing. For providing service oriented computing for the users of NARS, Indian NARS Statistical Computing portal has been strengthened by adding new modules. A National Agricultural Bioinformatics Grid (NABG) is being established 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.

A web based software developed by the Institute for Half Yearly Progress Monitoring (HYPM) of scientists in ICAR has been implemented from 1st April 2012 at all the Institutes/Bureaus/ Directorates/NRCs of ICAR for online submission of data regarding the proposed targets and achievements for the half yearly periods. A number of databases, web solutions, software and information/ expert systems have been developed. Appropriate statistical techniques have also been recommended to researchers of NARS through advisory services.

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. Twenty-one training programmes have been organised by the Institute during this period that includes two International training programmes (one sponsored by the FAO and the other for the participants from AARDO member countries). The national training programmes are 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 17 students {03 Ph.D. (Agricultural Statistics), 09 M.Sc. (Agricultural Statistics) and 05 M.Sc. (Computer Application)} have completed their degrees. A Senior Certificate Course in Agricultural Statistics and Computing was also organised.

Scientists of the Institute have published 94 research papers in National and International refereed Journals along with 27 popular articles, 3 books, 11 book chapters and 52 project reports/ technical reports/reference manuals.

I am extremely happy to note that some of our colleagues received academic distinctions during the year. Dr. VK Bhatia received Bharat Ratna Dr. C Subramaniam Award for Outstanding Teachers in Agriculture and Allied Sciences 2011 for excellent teaching in the field of Social Sciences from ICAR. Scientists of the Institute received various awards from Indian Society of Agricultural Statistics (ISAS) during International Conference on Statistics and Informatics in Agricultural Research. Dr. VK Gupta and Dr. VK Bhatia became ISAS fellow, Dr. Prajneshu received Sankhyiki Bhushan Award, Dr. Seema Jaggi received Prof. PV Sukhatme Gold Medal Award, Dr. Hukum Chandra received Dr. DN Lal Memorial Lecture Award and Dr. Ranjit Kumar Paul received Dr. GR Seth Memorial Young Scientist Award. Three research papers published in Journal of ISAS got Best Paper Award. One more research paper was awarded Best Paper in the National Conference on NexGen Biotechnology: Amalgamating Science and Technology at Kurukshetra University.

The scientists of the Institute were deputed in various national/ international conferences. This year, nine scientists were deputed on different assignments to EBI London, SIB Switzerland, Bangladesh, Bangkok, Thailand, Japan, USA and Columbia.

I wish to express my sincere appreciation to all Heads of Divisions, scientists and other staff of the Institute for providing the required information, for their devotion, whole-hearted support and cooperation in carrying out various functions and activities of the Institute. I wish to express my sincere thanks to all my colleagues in Prioritization, Monitoring and Evaluation (PME) Cell, in particular the in-charge PME Cell, Dr. Seema Jaggi, for the efforts in bringing out the report in time 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

- 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 | <ul style="list-style-type: none"> • Data Warehousing activities (INARIS project under NATP) initiated |
| 2002 | <ul style="list-style-type: none"> • Development of PIMSNET (Project Information Management System on Internet) for NATP |
| 2003 | <ul style="list-style-type: none"> • Establishment of National Information System on Long-term Fertilizer Experiments funded by AP Cess Fund • Development of PERMISnet (A software for Online Information on Personnel Management in ICAR System) • First indigenously developed software on windows platform released Statistical Package for Factorial Experiments (SPFE) 1.0 |
| 2004 | <ul style="list-style-type: none"> • National Information System on Agricultural Education (NISAGENET) Project launched • Training Programme for private sector initiated and conducted training programme for E.I. DuPont India Private Limited • E-Library Services initiated |
| 2005 | <ul style="list-style-type: none"> • Statistical Package for Augmented Designs (SPAD) and Statistical Package for Agricultural Research (SPAR) 2.0 released • Design Resources Server with an aim to provide E-advisory in NARS initiated |
| 2006 | <ul style="list-style-type: none"> • Organisation of International Conference on Statistics and Informatics in Agricultural Research |
| 2007 | <ul style="list-style-type: none"> • Establishment of Agricultural Bioinformatics Laboratory (ABL) |
| 2008 | <ul style="list-style-type: none"> • Software for Survey Data Analysis (SSDA) 1.0 released |
| 2009 | <ul style="list-style-type: none"> • Golden Jubilee Celebration Year of the Institute • Strengthening Statistical Computing for NARS initiated • Expert System on Wheat Crop Management launched • International Training Hostel inaugurated |
| 2010 | <ul style="list-style-type: none"> • Establishment of National Agricultural Bioinformatics Grid (NABG) in ICAR initiated • Division of Biometrics renamed 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 Bio informatics [CABin] created |
| 2011 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • Software for Survey Data Analysis (SSDA) 2.0 released • Division of Biometrics and Statistical Modelling renamed as Division of Statistical Genetics • Division of Forecasting & Econometrics Techniques renamed 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 |
| 2013 | <ul style="list-style-type: none"> • High Performance Computing (HPC) System for Biological Computing established |

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.

To achieve its goal and mandate, a number of research projects were undertaken during the year. Research was carried out under 68 research projects (01 National Professor Scheme, 38 Institute funded, 16 funded by other outside agencies and 13 in collaboration with other Institutes) in various thrust areas. This year 11 projects were completed and 19 new projects were initiated.

Some salient research achievements are as follows:

- To find a solution to the problem of unavailability of an efficient incomplete block design for given number of treatments, blocks and block sizes, the optimization techniques have been developed for construction of incomplete block designs.
- A R package called 'ibd' has been developed for construction of incomplete block designs using optimization techniques and is available on cran.r-project.org/web/packages/ibd/index.html. The

algorithm is fairly general in nature and can generate an efficient design for given parameters of the design, provided such a design is existent.

- Software Web Generation of Experimental Designs Balanced for Indirect Effects of Treatments (Webdbie) has been developed which generates randomized layout of series of Neighbour Balanced Block Designs and Crossover Designs. An online catalogue of these designs has also been included in the software.
- A class of minimally neighbour balanced row-column designs for even number of treatments with equal number of rows, columns and replications has been obtained which is variance balanced for the estimation of elementary contrasts pertaining to direct effects of treatments.
- Designs for veterinary trials for making comparisons of investigational products with active control(s)/ placebo have been obtained for the experimenters to establish superiority to placebo and at the same time allowing comparisons of the investigational products with an active control. Symmetric/asymmetric designs with factorial treatment structure suitable for multi-component drug-drug interaction study have also been obtained.
- In this era of decentralization, the thrust of planning process has shifted from macro to micro level, and so the thrust of research efforts has also shifted to development of precise estimators on small area inference using survey weights. The Pseudo empirical best linear unbiased prediction (Pseudo-

EBLUP) approach was used to develop design consistent small area estimator.

- Sample sizes for estimation of area and production of foodgrain crops, data of Crop Cutting Experiments (CCEs) for different crops (having smaller sample sizes) pertaining to number of States under Improvement of Crop Statistics (ICS) scheme were obtained from NSSO for the agricultural year 2010-11. Estimates of average yield for wheat and paddy crops at State level were obtained with suitable precision, however, for other foodgrain crops, these were obtained with very high estimates of percentage standard errors.
- Estimates of average yield of cotton along with percentage standard error has been obtained using double sampling ratio approach under stratified two stage sampling design framework for Aurangabad district of Maharashtra.
- The techniques of simple kriging, stratified kriging, simple co-kriging, stratified co-kriging were applied to remove cloud in the satellite images. Spatial imputation techniques were evolved for generation of cloud free images based on row-wise pixels, column-wise pixels, both row-wise and column-wise pixels, neighbouring pixels and by ratio and regression approach. Cloud free images were generated using all these techniques and then these techniques were compared by estimating area under paddy crop from the generated cloud free images.
- Different calibration estimators of the finite population total have been developed for two-stage sampling designs based on the assumption that the population level auxiliary information is available both at the psu and ssu levels. The variance of these estimators along with their estimators of variance has also been developed. The empirical evaluations revealed that all the developed calibration approach based estimators under two-stage sampling design were better than the usual estimator under two-stage sampling design with no auxiliary information.
- Sub-indices of Food Security Index (FSI) have been constructed for three states namely, U.P., Bihar and Punjab. Thematic maps were generated based on constructed FSI and their sub-indices for all the three States using Geographic Information System (GIS).
- Crop yield forecast model has been developed using Nonlinear Support Vector Regression (NLSVR) technique. The methodology has been illustrated to predict maize crop yield (response variable). NLSVR technique is found to be superior than that of Artificial neural network methodology in modelling and forecasting for the data under consideration.
- Semiparametric regression model using functional principal component scores was fitted to wheat-yield data and weekly weather data (temperature and sunshine hours) of Ludhiana district from 1984-85 to 2009-10 and was found to be superior to that of multiple linear regression model.
- Technology Forecasting (TF) tools have been employed to forecast future technological needs and trends in Indian agriculture. TF and Technology Assessment (TA) have been done with different tools, like Analytical hierarchy process, Brainstorming, Cross impact analysis, Fisher Pry/ Pearl, Gompertz and Lotka-Volterra substitution models, Framework forecasting, Scientometrics and Multi-Dimensional scaling. The agricultural subdomains/ commodities considered were Plant Breeding and Genetics, Rainfed Agriculture, Fisheries, Cotton and Rice. Implications of frontier sciences viz. Remote Sensing (RS) and Information and Communication Technology (ICT) on agricultural R&D have also been done.
- Secondary data on volumetric statistics on groundwater resources, groundwater table and source-wise irrigated area were analysed. The structure of water markets in North-Western Rajasthan was studied. It was observed that the three-fifths of net sown area in North-Western region were irrigated and the region was dominated by canal irrigation. Although, the annual growth in groundwater irrigated area was impressive (14 per cent) during 2000-01 to 2008-09, there was a further scope for groundwater development in the region as its development was 46 and 80 per cent in Sri-Ganganagar and Hanumangarh districts in 2009.
- A web based software for calculating codon usage indices and multivariate analysis for gene expression identification has been developed. It has modules for user management, reading or uploading nucleotide sequences, calculation of codon usage indices, and multivariate analysis with graphical output. A link between Java and R statistical package through JRI interface has been developed. This system is accessible any time from arbitrary platforms through internet.
- Microsatellite database and primer generation tool for pigeonpea (PIPEMicroDB) genome molecular

markers have been developed and are available at <http://cabindb.iasri.res.in/pigeonpea/>. Micro-satellite database of Buffalo (BuffSatDb) has also been developed and is available at <http://cabindb.iasri.res.in/buffsatdb>

- 7746 expressed sequence tags (ESTs) expressed in salinity stress condition were mined from different web resources, clustered and assembled into 672 contigs. Biological functions were obtained through gene ontology and mapped on to rice genome and full length gene sequences were designed that may be useful in molecular breeding programme in rice salinity research.
- Synonymous codon usage patterns have been analysed to identify the molecular signatures governing salt tolerance adaptation in *Salinibacter ruber* for inferring critical halophilicity features. The unique salt tolerant traits and genes responsible for salt stress could potentially be used in agricultural crops that are almost exclusively glycophytes. These findings may facilitate developing biofertilizers for improving fertility of saline soils.
- The gene expression data of chickpea under abiotic stress was subjected to consensus clustering to identify the co-regulated genes. Customization of penalized classifier called Least Absolute Shrinkage and Selection Operator (LASSO) using kernel function was done. Code of customized classifier was written in MATLAB and applied to gene expression data of *Arabidopsis thaliana* (Model Plant). Accuracy of the developed model has been tested through Leave One Out Cross Validation technique.
- Indian NARS Statistical Computing Portal (<http://stat.iasri.res.in/sscnarsportal>) has been strengthened by adding 13 new modules of analysis of data generated from Completely Randomized Designs, Resolvable Block Designs, Row-Column Designs, Nested Block Designs, Split-Split-Plot Designs, Split Factorial (main A, sub B x C) Designs, Strip Plot Designs, Response Surface Designs, Univariate Distribution Fitting, Test of Significance based on t-test and Chi-square test, Discriminant Analysis, Correlation and Regression Analysis. The data can be analysed by uploading *.xls, *.xlsx, *.csv and *.txt files.
- The Institute 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. Requirement study was carried out in collaboration with ICAR headquarters and partner organizations. System Design and Technical Development (Reports, Customizations) were developed in each functional area of FMS/MIS system.

- A web enabled Statistical Package for Factorial Experiments (SPFE 2.0) has been developed that gives the designs for symmetrical and asymmetrical factorial experiments and also performs analysis of the data generated. It generates randomized layout of the designs for factorial experiments with or without confounding. It also generates regular fractional factorial plans for symmetrical factorial experiments.
- Web based software for Half Yearly Progress Monitoring (HYPM) of scientists in ICAR (<http://hypm.iasri.res.in>) has been implemented from 1st April 2012 for online submission of data regarding the proposed targets for the half yearly period (01-04-2012 to 30-09-2012). It would be possible to monitor online progress of the scientists, manpower status, research projects, prioritized activities and salient research achievements at institute/SMD/ICAR level.
- For providing e-advisory and e-learning in sample surveys initiated a Sample Survey Resources Server (<http://js.iasri.res.in/ssrs/>) that provides calculator for sample size determination for population mean and population proportion among other material.
- For dissemination and e-advisory on designed experiments, strengthened Design Resources Server by adding links on Row-Column Designs in Two Rows; Block Designs with factorial treatment structure with Block Size 2 for Baseline parameterization; Books on Design of Experiments; Efficient binary proper incomplete block designs and Balanced Treatment Incomplete block designs.

Scientists of the Institute published 94 research papers in National and International refereed Journals along with 27 popular articles, 3 books, 11 book chapters, 19 papers in Conference proceedings and 52 project reports/technical reports/reference manuals. Seven macros/e-resources available at institute's website were also developed.

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

- Two International training programmes (one on Techniques of Estimation and Forecasting of Crop Production in India sponsored by FAO and other on Application of Remote Sensing and GIS in Agricultural Surveys for the participants from Afro-Asian Rural Development Organization (AARDO) member countries).
- Four 21 days training programmes under Centre of Advanced Faculty Training on Statistical Models for Forecasting in Agriculture, Recent Advances in Sample Surveys and Analysis of Survey Data using Statistical Software, Recent Advances in Designing and Analysis of Agricultural Experiments and Development of Expert System through AGRIdaksh were organised.
- Two Summer/Winter Schools on Forecast Modelling in Crops and Recent Advances on Quantitative Genetics and Statistical Genomics were organised.
- Two training programmes on Elementary Data Analysis and Website Development and Hosting for Technical Personnel of ICAR were organised.
- Five Resource Generation training programmes were conducted on Data Analysis and Interpretation: Use of Statistical Software for ISS probationers, Agricultural Statistics for Department of Agriculture, Govt. of Andhra Pradesh, Small Area Estimation for CSO, Functions and Activities of IASRI for NASA and Study tour on Agricultural System and Food Security Policy in India for DPR Korea sponsored by FAO.
- Six training programmes were conducted under National Agricultural Innovation Projects: Dissemination cum Training Workshop on Technology Forecasting Application in Agriculture Policy Analysis, Forecast Modelling in Crops using Weather and Geo-informatics, Sensitization programme under the project Strengthening Statistical Computing for NARS, Statistical Approaches for Genomic Data Analysis and Data Analysis using SAS.

Dr. VK Bhatia received Bharat Ratna Dr. C Subramaniam Award for Outstanding Teachers in Agriculture and Allied Sciences 2011 for excellent teaching in the field of social sciences from ICAR. Dr. VK Bhatia and Dr. VK Gupta received ISAS Fellow, Dr. Prajneshu was conferred on the prestigious title of Sankhyiki Bhushan, Dr. Seema Jaggi received Prof. PV Sukhatme Gold Medal Award for the year 2012 for her significant contribution in Agricultural Statistics, Dr. Hukum Chandra received

Dr. DN Lal memorial Award for the year 2012 for his significant contribution in Agricultural Statistics and Dr. Ranjit Kumar Paul received Dr. GR Seth Memorial Young Scientist Award for the Year 2012 from Indian Society of Agricultural Statistics. Dr. Himadri Ghosh received Bose-Nandi Award (jointly with Dr. Ramakrishna Singh and Dr. Prajneshu) for the best publication in the section application of statistics of Calcutta Statistical Association Bulletin. Dr. Anil Kumar received Smt. Kadambini Devi Award-2013 for best research paper by the Indian Society of Animal Production and Management.

Dr. UC Sud was nominated by the Ministry of Statistics and Programme Implementation as Non-official Member for Constitution of Working Group for formulating methodology for the 70th Round of NSS. Dr. Hukum Chandra elected as Member of International Statistical Institute, Netherlands. Dr. BN Mandal selected for Indo-Australia Early Career S&T Visiting Fellowship 2012-13.

Dr. VK Gupta visited UK to attend the meeting of the CRP 1.1 Dryland Systems - Integrated Agricultural Production Systems for the Poor and Vulnerable Dry Areas of the CGIAR at University of Reading, UK.

Dr. VK Bhatia was deputed to study the infrastructural facilities, exploring the possibility of collaboration and capacity building as a member of the team of five scientists constituted by ICAR at EBI, London and SIB Switzerland and to second meeting of the Steering Group of Agricultural Statistics Bangkok, Thailand.

Dr. UC Sud was deputed to attend Regional Workshop on Sampling for Agricultural Censuses and Surveys in Bangkok, Thailand and for the Consultancy on Harmonization and Dissemination of Unified Agricultural Production Statistics in Bangladesh.

Dr. Rajender Parsad was deputed to attend Session on Design of Experiments of 2nd Institute of Mathematical Statistics Asia Pacific RIM Meeting and presented an invited talk on Efficient Row-Column Designs for 2-colour single factor microarray experiments at Tsukuba, Japan.

Dr. Prajneshu was deputed to attend 13th International Pure Mathematics Conference 2012 and delivered an invited talk entitled Some Parametric Nonlinear Time-Series Models and their Applications in Agriculture at Islamabad, Pakistan and to participate in the International Conference on Advances in Interdisciplinary Statistics and Combinatorics held at UNCG, USA.



Dr. Anil Rai was deputed to study the infrastructural facilities, exploring the possibility of collaboration and capacity building as a member of the team of five scientists constituted by ICAR at EBI, London and SIB Switzerland.

Dr. Hukum Chandra was deputed to attend the 22nd Colombian Symposium in Statistics at Bucaramanga, Colombia.

Dr. AK Paul was deputed to attend three months NAIP HRD training in the area of Crop Bioinformatics (Comparative genomics in soybean's pathogens) at Iowa State University, Ames, Iowa, USA.

Dr. Prawin Arya was deputed to attend three months international training under NAIP on Policy Analysis: Sub area : Modeling for Land Use Planning (Social Sciences) at Iowa State University, Ames, Iowa, USA.

Sh. Sanjeev Kumar was deputed to attend training programme in the area of Bioinformatics and Comparative Genomics at Iowa State University, Ames, Iowa, USA.

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 17 students {03 Ph.D. (Agricultural Statistics), 09 M.Sc. (Agricultural Statistics) and 05 M.Sc. (Computer Application)} completed their degrees. 27 new students {10 Ph.D. (Agricultural Statistics), 07 M.Sc. (Agricultural Statistics), 06 M.Sc. (Computer Application) and 04 M.Sc. (Bioinformatics)} were admitted.

A Senior Certificate Course in Agricultural Statistics and Computing was organised and 07 officials participated in this Certificate Course.



ORGANOGRAM

RESEARCH ADVISORY COMMITTEE ↔ DIRECTOR ↔ INSTITUTE MANAGEMENT COMMITTEE



HEAD OF DIVISION

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

OFFICER INCHARGE

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

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

TRAINING ADMINISTRATION CELL

OMV UNIT

VIGILANCE OFFICER

SENIOR ADMINISTRATIVE OFFICER

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

SENIOR FINANCE AND ACCOUNTS OFFICER

- AUDIT SECTION
- ACCOUNTS SECTION

RESEARCH ADVISORY COMMITTEE

DIRECTOR

INSTITUTE MANAGEMENT COMMITTEE



Introduction

Indian Agricultural Statistics Research Institute (IASRI) is a premier 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. 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, information communication technology 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 is being 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 and Impact

A brief discussion on the research achievements in different areas of Agricultural Statistics and Informatics has been now outlined.

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.

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, α -designs, reinforced α -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 now 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 and 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 etc. have been undertaken. Most of the methodologies developed are being adopted for estimation of respective commodities by the concerned state Departments.
- The Institute is regularly publishing the Agricultural Research Data Book since 1996. It contains information pertaining to agricultural research, education and other related aspects compiled from different sources.

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 environments 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, livestock EST database, insect barcode 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.

- The Institute has made significant contributions in developing 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.
- The 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.

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 Communication Technology

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

- The Institute has developed information 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 districts/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 has also been developed.
- 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. Sample Survey Resources 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.

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 85 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. The Institute has so far produced 182 Ph.D. and 314 M.Sc. students in Agricultural Statistics and 105 M.Sc. students in Computer Application. A new degree course M.Sc. in Agricultural Bioinformatics has started from academic year 2011-12 in collaboration with IARI, New Delhi; NRCPB, New Delhi and NBPGR, New Delhi.
- 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 renamed as Centre of Advanced Faculty Training (CAFT). So far, 51 training programmes have been organised under the aegis of CAS/CAFT and in all a total of 931 participants have been benefitted.
- 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 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), softwares 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 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, Stat lab for Statistical analysis, Student lab and Centre for 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 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 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 data bases the awareness for the use of data bases has increased and users are able to access scientific information in the field of their interest without wasting their time 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
- Biometrics and Statistical Modelling
- Forecasting and Econometrics Techniques
- Sample Surveys
- Computer Applications
- Centre for Agricultural Bioinformatics [CABin]

On the recommendations of Quinquennial Review Team, the Council vide Office Order No.5-10/2011-IA-II(AE) dated 6 December 2012 has made following changes in the Divisions at IASRI w.e.f. 27 December 2012.

- Division of “Biometrics and Statistical Modeling Techniques” is renamed as “Statistical Genetics”.
- Division of “Forecasting & Econometrics Techniques” is renamed as “Forecasting & Agricultural Systems Modeling”.

Unit

- Institute Technology Management Unit (ITMU)

Cells

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

Financial Statement

The Institute was able to ensure optimal utilization of funds available in the budget. The actual utilization of the budget both under plan and non-plan is furnished as:

Budget Allocation vis-à-vis Utilization (2012–13)

Head of Account	Allocation		Expenditure	
	Plan	Non-Plan	Plan	Non-Plan
Pay & Allowances+ Pension & other retirement benefits	0.00	2631.00	0.00	2630.91
TA	6.00	3.00	6.00	2.98
OTA	0.00	0.50	0.00	0.42
HRD	3.00	4.00	3.00	2.48
Fellowship	0.00	37.93	0.00	37.13
Research & Operational Expenses	15.00	2.00	14.48	1.95
Equipments	47.00	8.00	23.27	7.96
Information Tech.	4.00	0.00	3.94	0.00
Furniture	0.00	0.00	0.00	0.00
Works	0.00	0.00	0.00	0.00
Library	40.00	0.00	40.00	0.00
Loan & Advances	0.00	8.68	0.00	1.60
Administrative Expenses	85.00	379.45	84.70	356.47
Other Miscellaneous	1.00	0.00	0.96	0.00
Total	201.00	3074.56	176.35	3041.90

Staff Position (as on 31 March 2013)

Manpower	No. of posts sanctioned	No. of posts filled
Director	1	-
Scientific	130	67
Technical	218	87
Administrative	84	80
Auxiliary	14	8
Skilled Supporting Staff	78	55
Total	525	297



IASRI NEWS

Volume 17, No. 4 January-March, 2013

- Research Achievements
- Research Resource Descriptions
- Research and Publications
- Researcher of Activities
- Publications
- Letters to the Editor
- Participation
- Conferences/Seminars/Workshops
- Personnel



From Director's Desk . . .

This newsletter highlights some of the vibrant research and training achievements made and other significant activities performed during the period under report. To find a solution to the problem of unavailability of an efficient incomplete block design, the optimization techniques have been developed for construction of incomplete block designs where an efficient incomplete block design is not available for given number of treatments, blocks and block sizes. A multi-step linear integer programming approach to construct a proper binary incomplete block design with specified parameters and concurrence matrix has also been developed. Nearly balanced concurrence matrix is also generated through the algorithm. Such concurrence matrices are known to lead to efficient designs.

There is demand by the administrators and policy planners for reliable estimates of various parameters at the micro level. In this area of decentralization, the thrust of planning process has shifted from macro to micro level. In view of the demands of modern times, the thrust of research efforts has also shifted to development of precise estimators on small area inference using survey weights. The Pseudo empirical best linear unbiased predictor (Pseudo-EBLUP) approach has been developed for small area inference. This approach is based on the use of the best linear unbiased predictor (BLUP) approach.

IASRI NEWS

Volume 17, No. 4 January - March, 2013

RESEARCH ACHIEVEMENTS

- Application of optimization techniques for construction of incomplete block designs. In order to maintain homogeneity among the experimental units within blocks incomplete block designs are very useful. Blocks, with number of experimental units smaller than the total number of treatments in the experiment, help in reducing the intra-block variance leading thereby to precise treatment comparisons. Incomplete block designs have been used in many agricultural experiments. However, the experimenters often face the problem of selecting a suitable design for given number of treatments, v , number of blocks, b and the common block size, k . An efficient incomplete block design may not be always available for given number of treatments, blocks and block sizes. For this purpose, the linear integer programming was used to obtain highly efficient incomplete block designs. A constraint satisfaction approach to construction of incomplete block designs with specified concurrence matrix has been proposed. A multi-step linear integer programming approach to construct a proper binary incomplete block design with specified parameters and concurrence matrix has also been developed. Nearly balanced concurrence matrix is also generated through the algorithm. Such concurrence matrices are known to lead to efficient designs. Using the two approaches,



सांख्यिकी-विमर्श

अंक 8

2012-13



भारतीय कृषि सांख्यिकी अनुसंधान संस्थान
(भा.कृ.अनु.सं.)
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IASRI ANNUAL REPORT 2011-12



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कृषि अनुसंधान डाटा पुस्तिका AGRICULTURAL RESEARCH DATA BOOK 2012



Research Achievements

The research targets set by the Institute were implemented by six Divisions of the Institute, viz. Design of Experiments, Statistical Genetics, Forecasting and Agricultural System Modelling, Sample Surveys, 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 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

Application of optimization technique based algorithms for construction of incomplete block designs

In order to maintain homogeneity among the experimental units within blocks incomplete block designs are very useful. Small blocks, with number of experimental units smaller than the total number of treatments in the experiment, help in reducing the intra-block variance leading thereby to precise treatment comparisons. Incomplete block designs have been used in many agricultural experiments. However, the experimenters often face the problem of selecting a suitable design for given number of treatments, v , number of blocks, b and the common block size, k . An efficient incomplete block design may not be always available for given number of treatments, blocks and block sizes. Therefore, the purpose of this study was to address the problem of obtaining highly efficient incomplete block designs using the optimization approaches, particularly the linear integer programming approach.

A constraint satisfaction approach for construction of incomplete block design with specified concurrence matrix has been proposed. A multi-step linear integer programming approach to construct a proper binary incomplete block design with specified parameters and concurrence matrix has also been developed. Nearly balanced concurrence matrix is also generated through the algorithm. Such concurrence matrices are known to lead to efficient designs. Using the two approaches, construction of different classes of binary incomplete block designs viz. balanced incomplete block designs, regular graph designs, semi-regular graph designs etc. is illustrated with examples. Modification of the algorithm for obtaining incomplete block designs for tests vs

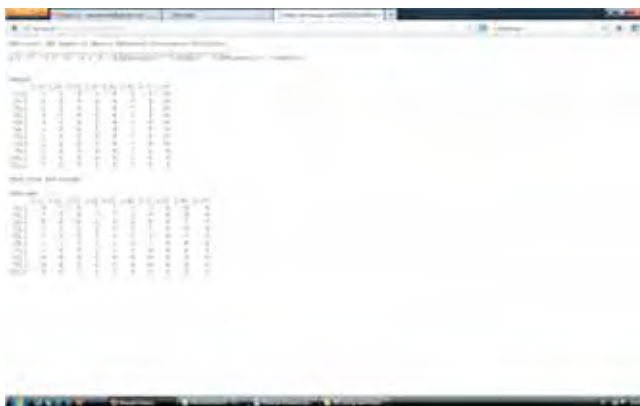
control(s) comparisons has also been shown and illustrated with examples. All the proposed methods have been implemented using R and SAS packages. An R package called 'ibd' has been developed and is available on cran.r-project.org/web/packages/ibd/index.html. SAS macros have also been prepared.

The algorithm is fairly general in nature and can generate an efficient design for given parameters, provided such a design exist. However, for the benefit of the experimenters a catalogue of efficient incomplete block designs in a restricted parametric range $3 \leq v \leq 20$, $b \geq v$, $2 \leq k \leq \min(10, v-1)$ with $vb \leq 1000$ is prepared. The layouts of the designs are available on Design Resources Server at <http://iasri.res.in/design/ibd/ibd>. A screenshot of the webpage containing the catalogues is given below.



Webpage containing catalogue of efficient incomplete block designs

The user can see the layout of the design for a given parametric condition, by clicking on the view design.



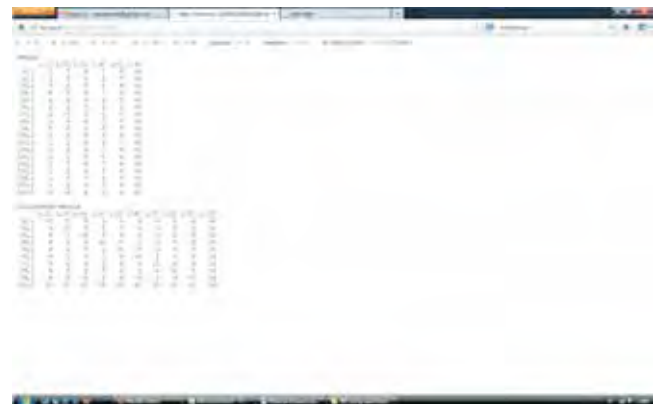
Layout of an efficient incomplete block design

The proposed algorithm has also been utilized to construct balanced treatment incomplete block designs for $2 \leq v \leq 12$, $v \leq b \leq 50$, $2 \leq k \leq v-1$. Balanced treatment incomplete block designs are useful for comparing test treatments with a control. A list of designs obtained in the above range is also presented. The layouts of the designs are available on Design Resources Server at <http://iasri.res.in/design/btib/btib>. A screenshot of the webpage containing the catalogues is given below.



Webpage containing catalogue of balanced treatment incomplete block designs

By clicking on the view design for a given parametric combination, user can see the layout of the design.



Layout of a balanced treatment incomplete block design

Strengthened Design Resources Server

For dissemination of research in Design of Experiments, Design Resources Server (www.iasri.res.in/design) was further strengthened through adding new link on orthogonal arrays. It has been strengthened by adding the following links:

Row-column designs in two rows

- Row-column designs in two rows are useful for 2-colour microarray experiments. A new link ‘Catalogue and Generation of Row-Column Designs’ (<http://www.iasri.res.in/drs/>) has been initiated for generation of Row-Column designs with two rows along with lower bounds to A- and D- efficiencies for parametric range $3 \leq v \leq 10$, $v \leq b \leq v(v-1)/2$, $11 \leq v \leq 35$, $b = v$, and $(v, b) = (11, 12), (11, 13), (12, 13), (12, 14), (13, 14), (13, 15), (13, 16)$ under fixed and mixed effects models. Some screen shots are as.



Block designs with factorial treatment structure with block size 2 for baseline parameterization

- Developed a module for online generation of block designs with block size 2 for factorial experiments with baseline parameterization in $b = v-1$

blocks (where v is the number of treatment combinations $v = s_1 \times s_2 \times \dots \times s_n$, $2 \leq n \leq 10$ factors and $v = s_1 \times s_2 \times \dots \times s_n$ and for 2 factor mixed level factorial experiments in $v-1 \leq b \leq (v-1)+(s_1-1)(s_2-1)$ arrays and made available at <http://www.iasri.res.in/dbp/>. Some screen shots are given below.



Books on Design of Experiments

- A list of books on Design of Experiments has been provided for the benefit of the visitors of this web resource, the faculty, the researchers in Design of Experiments and the students. No claim is being made for this list to being exhaustive. New additions would be made to it from time to time.

Usage of the Server

- The server has a facility of ‘Ask a Question’ through which a lot of questions are being received and answered. More than 40 questions asked through the link ‘Ask a Question’ were answered for providing e-advisory services.
- During 01 April, 2012 - 31 March, 2013, Google analytics gave 12342 page views through 458 cities of 91 countries. Average time taken on page was 3.51 minutes.



Design Resources Server / Design Reso...		Thursday, 01 / 29 / 2012	
Design Resources Server		2:56:52 PM	
Mansy Kumar	mansy_kumar@yahoo.com	I analyzed a response surface design having four factor each at three level there are four independent and eight dependent variable. your stress is in 11 back of it but there is three in back of it for about all dependent variable. in this situation, what should I need to do to make back of its insignificant?	Please let me know how do you analyze the data? Did you perform using PROC RSREG of SAS? If there can you show the syntax used and results of one parameter? I shall be able to comment after knowing you on this.
Nagar	nagar1188@gmail.com	DETAILS ABOUT PRINCIPLE COMPONENT ANALYSIS	Please see lecture notes on Multiple Techniques: An Overview in Module IV of Electronic Book on Advances in Data Analytical Techniques available at http://iasri.iasri.res.in design ebook READAT
Mansy Kumar	mansy_kumar@yahoo.com	Respected sir, I have two factors (Bacterial and Enzyme) each at three level it is replicated three times. We have 27 design points. I want to analyze using Response surface design. Can we construct second order rotatable design or central composite design or Box-Behnken design. Can I call the full factorial and analyze using response surface methodology.	Once the experiment is conducted, the design cannot be changed. Design has to be chosen before the experiment is conducted. You can consider it a factorial.
Devil Brandy	v.brandy@biobiosoft.com	How would you analyze data when the response is not binary the covariate is not carbon and the two level factors are distance from market (near or far) and land type (agricultural or forested)?	Please let me know the way data is collected. Is it a designed experiment or a survey data? If designed experiment, which design was used? If it is a survey

Efficient designs for drug testing in veterinary trials

- Veterinary trials are generally conducted for drug testing, to solve specific and practical problems like diseases and toxicology testing or safety testing conducted by pharmaceutical companies. Research on living animals is carried out when it will reveal information which cannot be obtained in other ways. For ethical and economic reasons, it is important to design veterinary trials well, to analyze the data correctly and to use the minimum number of animals to achieve the objectives. A method of constructing designs for making comparisons of investigational products with two active controls has been obtained that are suitable for veterinary trials. The two controls can also be taken as one active control and placebo facilitating the experimenter to pursue multiple goals in one trial like establishing superiority to placebo and at the same time allowing comparisons of the investigational products with an active control. The efficiency of these designs under a nested model by considering several observational units within each experimental unit, in comparison to an orthogonal design with same number of treatments has been studied. Further, in a drug-drug interaction study the purpose of the experimenter is to investigate whether co-administration of two or several drugs will alter the

absorption profile of each drug. For the class of symmetric factorial (v^3), row-column designs (RCDs) with $3v$ rows and v^2 columns, developed for studying the multi-drug interaction effects, the general form of effects confounded in rows and columns have been identified and are found to be of third order.

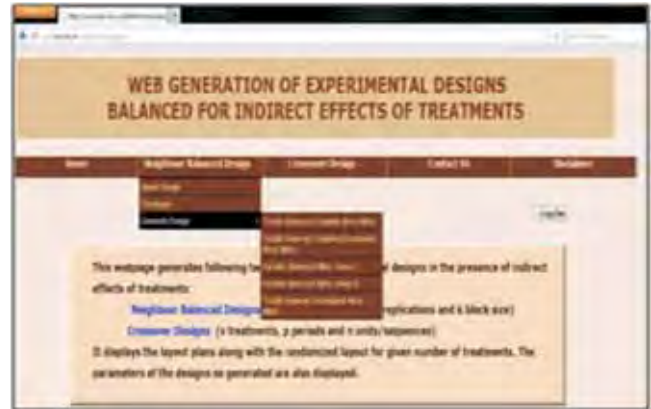
Experimental designs in the presence of indirect effects of treatments

- Indirect effects are effects which occur in an experiment due to the units which are adjacent (spatially or temporally) to the unit being observed. A class of complete circular block designs strongly balanced for spatial (neighbour) effects up to distance 2 has been obtained. The parameters of the design so obtained are v , $b = v(v-1)/2$, $r = (v-1)(2v-1)/2$ and $k = 2v-1$. The information matrix for estimating the direct as well as spatial indirect effects from the neighbouring units has been derived and the designs are found to be totally balanced.
- A class of strongly balanced designs balanced for temporal indirect effects up to second residual effects has also been obtained. The parameters of the design so obtained are v (prime) treatments, $p = v(v-1)$ periods and $n = v$ experimental units.



- A class of minimally neighbour balanced row-column designs with parameters v (even), $p = q = r = v$ has been obtained which are variance balanced for the estimation of elementary contrasts pertaining to direct effects of treatments.
- Universal optimality of block design with spatial indirect effect from neighbouring unit 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.
- Considering more than one relationship between observations on units over space, two series of linear trend free block (one complete and one incomplete) designs balanced for estimating direct and neighbour indirect effect of treatments have been proved to be trend free for higher order trend effects.
- A large number of Neighbour Balanced Designs (NBDs) and Crossover Designs (CODs) are developed in the literature. For easy accessibility and quick reference of these designs by the experimenters, a software Web Generation of Experimental Designs Balanced for Indirect Effects of Treatments has been developed and deployed at www.iasri.res.in/webdbie. List of neighbour balanced block designs and crossover designs for $v \leq 20$ was prepared for developing the online catalogue. The designs can also be generated from the online catalogues developed for the purpose. This software provides freely available solution for the researchers and students working in this area.

- The software generates five classes of Neighbour Balanced Block Designs (v treatments, b blocks, r replications and k block size) and eight classes of Crossover Designs (v treatments, p periods and n units/sequences).



Neighbour Balanced Designs

- The webpage displays the layout plans along with the randomized layout for given number of treatments. The parameters of the designs so generated are also displayed. The details of the designs are also included.



Neighbour Balanced Design for $v = 5$



Home Page



Crossover Designs

Crossover design for $v = 5, p = 5, n = 10$

Periods	Experimental Units									
	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	5	1	2	3	4
2	5	1	2	3	4	1	2	3	4	5
3	2	3	4	5	1	4	5	1	2	3
4	4	5	1	2	3	2	3	4	5	1
5	3	4	5	1	2	3	4	5	1	2

Crossover (Williams Square) Design for $v = 5$

- The online catalogue ($v \leq 20$) of Neighbour Balanced Designs and Crossover Designs has been developed and is included in the software. Search facility of all designs and designs for some particular value of parameters have been provided showing the layout of the design.

Catalogue Of Neighbour Balanced Designs

Design	ID	v	k	r	k
Design 1	1	5	2	2	5
Design 2	2	5	4	4	5
Design 3	3	5	5	4	4
Design 4	4	5	20	16	4
Design 5	5	5	20	20	5
Design 6	6	7	3	3	7
Design 7	7	7	6	6	7
Design 8	8	7	7	6	6
Design 9	9	7	42	24	4
Design 10	10	7	42	30	5
Design 11	11	7	42	36	6
Design 12	12	7	42	42	7
Design 13	13	8	4	4	8
Design 14	14	11	5	5	11
Design 15	15	11	10	10	11
Design 16	16	11	22	10	5
Design 17	17	11	11	10	10
Design 18	18	11	110	40	4

Mating-Environmental designs under two-way blocking setup

Mating-Environmental Row-Column (MERC) designs are suitable for breeding programmes compared to traditional mating designs as it provides designs which serve both the purposes, i.e. mating designs laid out using a row-column design, for the breeders. MERC designs yields more precise comparison among general combining

ability (gca) effects as they eliminate two perpendicular source of variations in the field. They facilitate comparison among gca effects free from specific combining ability (sca) effects. Three series of designs which are variance balanced for estimating the elementary contrasts pertaining to gca effects free from sca effects are

Series 1: The parameters are number of crosses (v) = number of rows, (p) = number of columns, (q) = number

of replications, (r) = $\frac{t(t-1)}{2}$, where t is the number of

lines. For this class of MERC designs, the information matrix for estimating the contrasts pertaining to crosses is

$$C_A = \frac{t(t-1)}{2} \left[I - \frac{2J}{t(t-1)} \right]$$

and the information matrix for estimating the contrasts pertaining to gca effects after eliminating sca effect is of

the form
$$C_{gca} = \frac{(t-1)^2}{2(t-2)} \left[I - \frac{J}{(t-1)} \right].$$

Series 2: The parameters are $v = \frac{t(t-1)}{2}$,

$$p = \frac{(t-3)(t-2)}{2}, q = \frac{t(t-1)}{2} \text{ and } r = \frac{(t-3)(t-2)}{2},$$

where t (number of lines) should be a prime number. For this class of designs, the information matrix for estimating the contrasts pertaining to gca effects after eliminating sca effect is

$$C_{gca} = \frac{t(t-3)(t-4)}{2(t-2)^2} \left[I - \frac{J}{t} \right].$$

Series 3: The parameters are $v = \frac{t(t-1)}{2}$, $p = \frac{t(t-1)}{2}$,

$q = t$ and $r = t$, where t should be a prime number. For this class of MERC designs, the crosses are partially balanced and the information matrix for estimating the contrasts pertaining to gca effects after eliminating sca effect is of

the form
$$C_{gca} = \frac{t}{(t-2)} \left[I - \frac{J}{t} \right].$$

- Developed macros using SAS IML (Interactive Matrix Language) for generation and randomization of three series of MERC designs for the above three series of



designs which will be of immense use to researchers for constructing MERC designs as it provides ready-made layout plans.

- Methodology has been developed for the orthogonal partition of the information matrix for estimating elementary contrasts pertaining to gca and sca effects from a diallel (or partial diallel) cross experiment laid out under a two-way blocking set up considering F_1 's along with Selfing's (Griffing's method II).

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 received from eight cooperating centres of 2010-11 and two cooperating centres of 2011-12 were analysed.

The mixed model methodology has been used for the repeated measure analysis of two cooperating centres Coimbatore and Bangalore (for both kharif and rabi seasons) by taking year as time variable for the data of grain yield. Treatment, year and the interaction treatment \times year are highly significant at both the centres. In general, least square means were highest for the treatment 100% NPK+FYM for both Rabi and Kharif seasons for both the centres. For the Coimbatore cooperative centre of Kharif season, data of 38 years were analyzed by making four groups according to trend in grain yield. An increasing trend was observed during the period 1981-82 to 1994-95. The data of seventeen cooperating centers for all the characters of LTFE is now available at the site <http://www.iasri.res.in/isde>.

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 Sustainable production system are planned and conducted at 31 On Farm Centres (OFR) in farmers' field under Project Directorate of Farming Systems Research, Modipuram during 2010-11. The data of 117 experiments conducted at 2286 farmers' field at OFR centres are processed for statistical analysis.

- During 2011-12 a new experiment "On-Farm Integrated Farming System Research" has been initiated at 28 OFR Centres replacing the experiment (sustainable production system). The objective of this experiment is to address critical constraints of small and marginal farmers' for overall productivity improvement and to increase the profitability of households and ensure livelihood security of the farmers. The treatments are formed by making interventions in modules of different components of integrated farming system (IFS) such as crops, animals, value addition and processing / subsidiary enterprises and kitchen gardening/poultry/fisheries etc. By using the input and output costs of these interventions in various modules of IFS, the impact of interventions in terms of productivity and profitability of small and marginal farmers can be evaluated.
- On line data entry of experiment "Response of nutrients" conducted during 2011-12 has been initiated for the first time by OFR Agronomists and On-line data entry and analysis by 24 OFR Agronomists has been carried out. Statistical analysis of the data of 36 experiments (Diversification and/or Intensification of cropping system) conducted at 28 OFR Centres during 2011-12 has been processed for statistical analysis.
- Coefficient of variation (CV) of On-Farm experiments conducted during 2011-12 have been evaluated and presented in the tables. In experiment (Response of nutrients), the analysis have been carried out for crop yields and two characters analysis have been done for experiment "Intensification/Diversification of cropping system" namely caloric value and net return obtained in the cropping sequences.

Distribution of CV(%) in ON-FARM experiments

Type of Experiment	CV				
	0-5	5-10	10-15	15-20	> 20
Experiment-1	11	34	2	-	1
Experiment-2	25	25	14	5	-

It is observed that 34 of the experiment-1 have percent coefficient of variation (C.V.) in the range of 5 to 10 %. The C.V. of experiment-2 has been found in 25 cases in both 0-5 and 5-10% range, whereas it is observed that C.V. in 5 cases is in 15-20% range.

Information System for Designed Experiments (ISDE)

ISDE is a web-enabled information system (available as a link on <http://www.iasri.res.in>) wherein, presently, information relating to databases on agricultural field experiments (excluding purely varietal trials) conducted in the country, on-farm and on-station experiments conducted under the supervision of Project Directorate of Farming Systems Research and Long Term Fertilizer Experiments are stored and maintained on-line. During the period under report, regular activities like collection, storage, validation and retrieval of experimental data were in progress. Agricultural Field Experiments Database contains more than 33000 experiments on different crops. Data relating to 1317 experiments have been entered on-line between 01 January, 2012 and 31 December, 2012.

As part of integration of distinct databases, a common script has been written to generate report based on databases from AFEIS, On-Farm Experiment-1 (Response of nutrients) and On-Station Experiment-1A (Intensification / Diversification of cropping sequence based on high value crops). The report supplies combined report of:

- Year and Objective of AFEIS experiments
- Year and crop sequences of On-Farm experiments-1 and
- Year and Treatments of On-Station experiments-1A

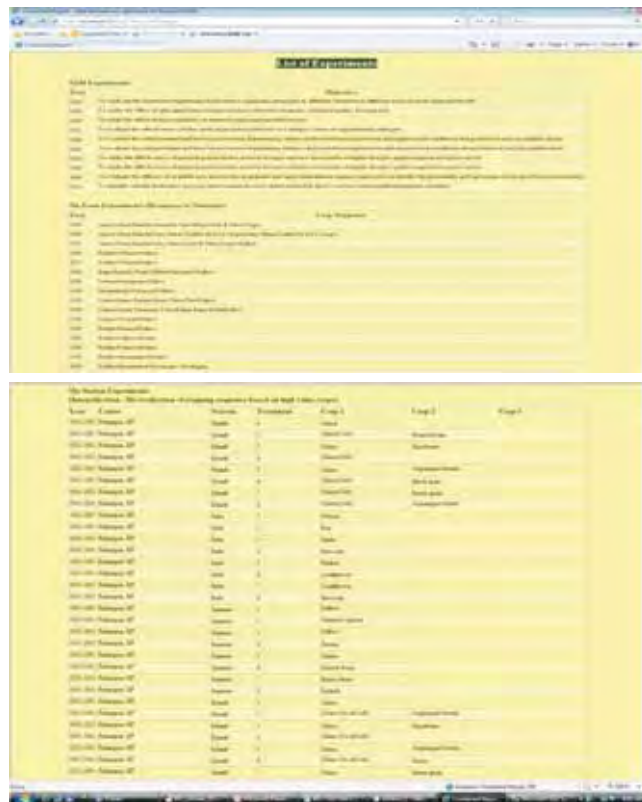
Some important achievements in this system are:

- On-line entry of eleven (11) experiments by the individual scientists,
- On-line data entry for On-farm Experiment-1 (Response of nutrients) by different centers. Analysis and other reports were generated for 21 centers. Rest 9 centers are being processed and
- On-line data entry for LTFE was successfully tested for Pantnagar and Bhubneshwar centers.

Clicking on ISDE link on IASRI site www.iasri.res.in gives the home page as follows:



Given below is the combined report of index of experiments for the three databases AFEIS, On_Farm Experiment-1 and On-Station Experiment-1A:



Planning, designing and analysis of experiments planned On Stations under the Project Directorate for Farming Systems Research

For the Project Directorate for Farming Systems Research, the experiments On Stations are planned and conducted under four types of research programmes viz. Development of new cropping systems; Nutrient management in cropping systems; Development of system based management practices and Maximum yield research using randomised complete block (RCB) design, factorial RCB design, split plot designs, strip plot designs and reinforced 32 x 2 balanced confounded factorial experiments.

- Analysis work for the 158 experiments conducted during the year 2010-11 has been completed. Data of 300 experiments conducted during the year 2011-12 have been received and analysis of 56 experiments has been completed. Results have been tabulated in the form of summary tables and have been sent to



the respective scientist- in-charge of the cooperating centres. The final tables of the results of the experiments have been prepared and sent to Project Directorate for Farming Systems Research, Modipuram for inclusion in the Project Report of All India Coordinated Research Project on Integrated Farming Systems.

- Combined analysis of data of the experiment (2a) [Permanent plot experiment on integrated nutrient supply system in a cereal based crop sequence] pertaining to three centres viz., Bhubaneswar, Sabour and R S Pura was performed separately for kharif and rabi seasons and it was found that mean square errors estimated over years were heterogeneous as per Bartlett’s chi-square test. Further, the data were subjected to Aitken’s transformation as the mean square errors estimated over years were heterogeneous for all the data set. The transformed data were further analysed and it was found that the Year × Treatment interaction was significant. Hence, the treatment effects were tested against Year × Treatment interaction and subjected to Tukey’s HSD to identify the best treatment group. At Bhubaneswar centre it was found that for kharif crop T₁₁ (75% recommended NPK dose through fertilizers+ 25% N through green organic matter (green leaf manuring or through Azolla)) is the best treatment giving maximum average yield and which is significantly different from the rest. At Sabour centre in rabi crop, both T₆ (75% recommended NPK dose through fertilizers) and T₁₀ (100% recommended NPK dose through fertilizers) are found to be at par and are significantly different from the rest. It was also found that for kharif crop T₆ (50% recommended NPK dose through fertilizers + 50% N through Compost/FYM/ Gobar gas slurry) and T₇ (75% recommended NPK dose through fertilizers + 25% N through Compost/ FYM/Gobar gas slurry) are at par on giving maximum average yield. For rabi crop, T₆ (75% recommended NPK dose through fertilizers) is found to be the best treatment giving maximum average yield and which are significantly different from the rest and at RS Pura centre, It was also found that for kharif crop T₅ (100% recommended NPK dose through fertilizers), T₆ (50% recommended NPK dose through fertilizers + 50% N through Compost/FYM/Gobar gas slurry) and T₇ (75% recommended NPK dose through fertilizers + 25% N through Compost/FYM/Gobar gas slurry) are at par on giving maximum average yield. For rabi crop, T₆

(75% recommended NPK dose through fertilizers) is found to be the best treatment giving maximum average yield and which are significantly different from the rest.

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

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

The commodity basis pattern was predicted for the upcoming time as a mixture of historical commodity basis pattern. It was assumed that Y(t) is distributed as a mixture of Gaussian processes

$$Y(t) \sim \sum_{k=1}^K \pi_k f_k(\cdot | t)$$

where K is the number of mixture component and f_k is the density function of the kth Gaussian mixture component with mean function and covariance surface μ_k(t) and Σ_k(t, t') respectively.

As in Functional Clustering approach, the parameters were estimated by maximizing mixture likelihood function. Programs for application of Functional clustering approach have been developed using R software. Cash price and future price data of soybean for Indore have been collected from NCDEX (National Commodity and Derivatives Exchange Limited) website. A total of 2448 data points were used for model development and 300 data points were used for model validation purpose. The methodology has been applied to predict commodity basis which is a function of cash price and future price. Using commodity basis, predicted cash price (Rs/Kg) of Indore market has been obtained. The performance of the method in forecasting cash price of soybean is given below.

Measures	Number of Clusters							
	3	4	5	6	7	8	10	12
Mean Absolute Error (MAE)	2.70	3.05	2.85	2.47	2.85	2.83	2.95	2.97
Root Mean Squared Error (RMSE)	3.70	4.55	3.83	3.30	3.92	3.88	4.04	4.09
Mean Absolute Percentage Error (MAPE)	7.47	8.26	7.94	6.99	7.86	7.83	8.17	8.19



Predicted cash price (Rs./Kg) of Soybean (Indore market) along with actual data.

Programs for application of support vector regression technique have been developed using R software. The methodology has been illustrated to predict maize crop yield (response variable). Four predictor variables considered were total human labour (Rs./ha), farm power (Rs./ha), fertilizer consumption (kg./ha) and pesticide consumption (Rs./ha).

It is clear from the results that the Support vector regression technique perform better than Artificial neural network methodology in modelling and forecasting the data under consideration.

Performance of different methods in modelling

Measures	Support Vector Regression	Artificial Neural Network
MAE	7.53	7.87
RMSE	9.26	9.53

Predicted maize crop yield and Goodness-of-fit measures

S. No.	Actual Maize Yield	Predicted Maize Yield	
		Support Vector Regression	Artificial Neural Network
1.	25.00	24.56	26.28
2.	36.14	36.85	37.13
3.	43.67	41.06	40.60
4.	22.32	22.29	23.92
5.	29.94	30.39	30.91
6.	37.31	38.31	38.62
7.	32.93	31.59	31.38
8.	36.32	35.49	34.91
9.	18.75	19.27	20.29
10.	17.75	16.46	16.98

Goodness-of-fit measures

MAE	0.92	1.45
RMSE	1.15	1.57
MAPE	3.04	4.99

Weather based forewarning models for Onion Thrips (*Thripstabaci Lindeman*)

For this study data have been taken from Directorate of Onion and Garlic Research (DOGR), Pune. The field trials were conducted on different dates at fortnightly intervals (15-Jun, 01-Jul, 15-Jul, 01-Aug, 15-Aug, 01-Sep, 15-Sep, 01-Oct, 15-Oct, 01-Nov, 15-Nov, 01-Dec and 15 Dec.) in different seasons at Pune during 2000 to 2008. Models were developed for each date of planting of crop. Weekly data on weather variables starting from one week before the crop sowing up to two weeks of crop growth were considered for forewarning time (crop age) of first appearance of thrips (Y_1), whereas weather variables starting from one week before the crop sowing up to six weeks of crop growth were considered for forewarning time (crop age) of peak population of thrips (Y_2) and maximum thrips population (Y_3). Weather variables namely maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, bright-sunshine hours (for rabi season only) and rainfall (for kharif season only) were considered. Models have been validated using data on subsequent years not included in developing the models. The forecasts for different characters in various dates of planting were at par with the observed ones. The percentage deviation of forecast for different characters in various dates of planting using weather indices based regression models were low for crop age at first appearance of thrips (Y_1) and crop age at peak population of thrips (Y_2) whereas deviation was higher for maximum population of thrips (Y_3). An attempt has been also made to develop fuzzy regression models, for various characters in different dates of planting. The average widths for linear regression models vis-a-vis their fuzzy counterparts were much higher for all values of fitness criterion (h). Thus, fuzzy regression methodology is more efficient than linear regression technique. The pattern over the crop season for onion thrips has been developed through non-linear models taking time as independent parameter for different dates of planting. The following was considered for this purpose,

$$Y_t = ae^{-bt} (1+de^{-bt})^{-2} + \epsilon$$

Y_t is counts of thrips at time t. The residuals were analyzed for all dates of planting of onion thrips in different years. Similarly, for each data set Shapiro-Wilk statistic was calculated. The result showed that none of the assumptions of randomness and normality of residual was violated for any data set. The model provided a good fit to all the data sets. Thus, this model captured the fluctuations in thrips population in different years. Neural

networks models were developed for weekly thrips population considering the residuals (obtained through non-linear models taking time as independent parameter for different dates of planting) as output variable and weather indices as input variables. MLP based neural network with different hidden layers (one and two) and different number of neurons in a hidden layer with hyperbolic function as an activation function was obtained for weekly thrips population. Models have been validated using data on subsequent years not included in developing the models. Mean Absolute Percentage Error was minimum for neural network approach which indicated that reliable forewarnings were possible well in advance using this technique.

The composed error model was used to estimate a damage function for thrips population. Using data from the experiments, the estimated damage function such as Linear, Logistic, Quadratic, Cobb–Douglas, Negative exponential and Hyperbolic were used to estimate expected yield loss due to thrips in onion in Pune. The results revealed that the mean proportional yield losses was 20.3 % for Cobb–Douglas damage function.

Pest and diseases dynamic vis-a-vis climatic change under National Initiative on Climate Resilient Agriculture (NICRA)

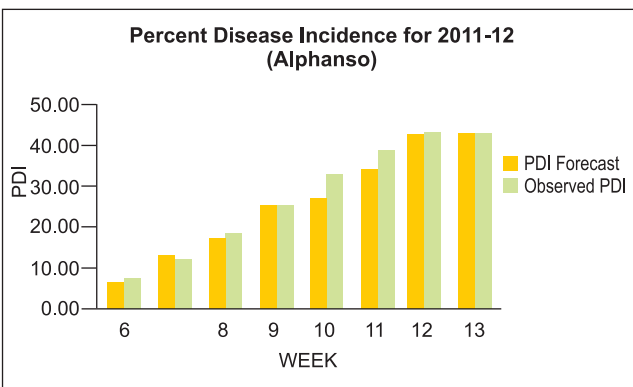
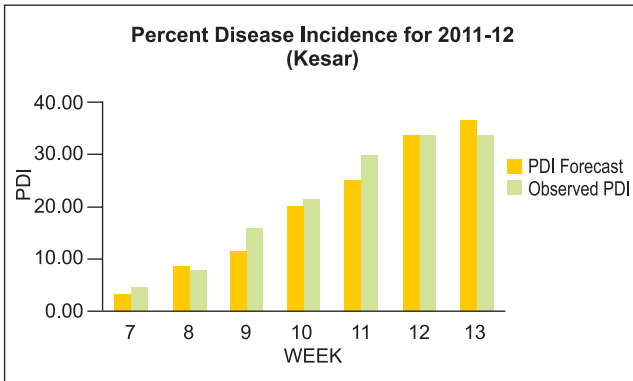
Weekly weather data on maximum temperature (MaxT), minimum temperature (MinT), relative humidity in the morning (RH1), and in the afternoon (RH2), rainfall (RF) / bright sunshine hours (BSH) for various locations (Kanpur: 1971-2011; Hyderabad: 1980-2010; Bangalore: 1980-2010; Pusa: 1980-2010; Pantnagar: 1970-2008; Prabhani: 1980-2010; Varanasi: 1980-2008; Pune: 1971-2008; Raipur: 1971-2011; Anantpur: 1985-2010; Mandya: 1985-2011 and Warrangal: 1982-2011) were considered. For each location, 52 weekly series, 3 seasonal series and 12 monthly series were obtained. For each series, trends through non parametric methods were obtained for various meteorological variables for different locations. Besides, the monthly rainfall series data for 141 years (1871–2011) for 30 meteorological sub-divisions in India along with temperature (maximum and minimum) for all-India and seven homogeneous regions, viz., Western Himalaya (WH), Northwest India (NWI), North Central India (NCI), Northeast India (NEI), West Coast (WC), East Coast (EC) and Interior Peninsula (IP) for the period 1901-2007 from Indian Institute of Tropical Meteorology (IITM: <http://www.tropmet.res.in>) were also obtained. The monthly long-

term annual, seasonal and monthly trends in rainfall in different sub-divisional meteorological stations and trends for temperature (maximum and minimum) for various homogenous regions were also investigated. To ascertain the presence of statistically significant trend in climatic variables such as temperature, relative humidity, rainfall and bright sunshine hour, non-parametric Mann–Kendall (M-K) test has been employed. The M-K test checks the null hypothesis (H_0) that the data $(x_1, x_2, x_3, \dots, x_N)$ have no trend versus the alternative hypothesis of the existence of increasing or decreasing trend.

Sen's estimator has been used for determining the magnitude of trend in meteorological time series data. Weather indices based models for Pod Borer (% pod damage due to pod borer) have been developed for Gulbarga, Kanpur and Rahuri. Initiated the disease–pest forewarning models in crops for national agro-advisory service using SATMET product at IMD (Agrimet), Pune in collaboration with NCIPM, New Delhi.

Weather based forewarning of mango pests

Weather based models have been developed for forewarning time of first appearance (for Mohanpur and Paria – Kesar and Alphanso varieties) and weekly disease incidence of powdery mildew at Paria for two varieties (Kesar and Alphanso). Weather indices have been obtained using the data on weather variables which have been used as regressors alongwith time of flush in the model for forewarning time of first appearance. For forewarning weekly disease incidence, the model was developed under the assumption that disease incidence was due to two reasons, natural disease growth pattern (non-linear model) and weather. Therefore, the model has been developed in two steps, modeling natural growth pattern and relating the deviations (from natural pattern) to appropriate lagged weather variables. Stepwise regression technique has been used to select the important variables in the model. Using these models, reliable forewarning of time of first appearance of disease (within a difference of one week) could be provided at the earliest at 2nd standard meteorological week (smw) for Mohanpur and 47th smw for Paria. Reliable forewarning of weekly per cent disease incidence (PDI) could be obtained using weather and per cent disease incidence upto preceding week. Forecasts of weekly PDI for subsequent year at Paria for the two varieties are given in the following figures .



Development of forecasting module for podfly, *Melanagromyza obtusa* Malloch in late pigeonpea

Development of models based on qualitative as well as quantitative data has been attempted for forewarning damage due to pod fly in late pigeonpea for Kanpur using historical data. Regression models were developed using weather indices as independent variables while % pod damage was used as dependent variable. Forecasts have been obtained for subsequent years not included in model development. Models for forecasting of % pod damage due to pod fly at different weeks of forecast were obtained. For qualitative forewarning, data in the quantitative form was classified in to two categories by taking epidemic status as 1 for the pod damage (%) more than 15 and 0 otherwise. For development of model for forewarning epidemic status, logistic regression model was used taking weather indices as regressors. The results indicated that for most of the years the approach provided correct epidemic status and forecast for % pod damage closed to the observed ones. Reliable quantitative forecasts for per cent damage due to pod fly in late pigeonpea at Kanpur could be obtained at 4th smw using data on maximum temperature, minimum temperature

and evening relative humidity. Over all epidemic status (qualitative forewarning) could be provided at first smw using data on max. temperature and evening relative humidity. Forecast for subsequent years (not included for model development) captured qualitative status correctly. The quantitative forecasts for % pod damage were 38.18 and 35.1 against observed values 31.7 and 32.5 for the years 2010-11 and 2011-12 respectively.

Study on robustness of sequential testing procedures on some distributions used in agricultural pest control

Sequential testing procedure was developed for testing the hypothesis $H_0: \alpha = \alpha_0$ against $H_1: \alpha = \alpha_1 (\alpha_1 > \alpha_0)$ for the parameter α when the other parameter 'm' is known for size-biased negative binomial distribution with probability mass function

$$P(X=x) = \binom{m+x-1}{x-1} \alpha^{x-1} (1-\alpha)^{m+1}; x = 1, 2, \dots$$

where $0 < \alpha < 1, m > 0$.

Decision criteria has been developed over the stopping

bounds $A = \frac{1-\beta}{\alpha}$ and $B = \frac{\beta}{1-\alpha}$ with strength (α, β)

of the test. The estimating equation of

$$E \left[\left\{ \frac{\alpha_1}{\alpha_0} \right\}^{h(X, -1)} \left\{ \frac{1-\alpha_1}{1-\alpha_0} \right\}^{(m+1)h} \right] = 1,$$

has been derived for solving non-zero solution of 'h' for the size-biased negative binomial distribution. Sequential probability ratio tests have also been developed to test simple hypothesis for unknown parameter of a family of continuous distributions when another parameter is known.

Development of forecasting methodology for fish production from ponds of upland region

Fish growth data of three different fish species viz., grass carp, silver carp and common carp obtained from polyponds and earthen ponds were thoroughly analyzed. Different growth models were attempted to fit the growth datasets of fish obtained from polyponds and earthen ponds. There was no extreme autocorrelation and the assumption of homoscedastic error structure was not

violated. Also, residual analyses showed that the randomness assumption and normality assumption were fulfilled. However, the high correlation among the estimated parameters and the nonlinear behavior of the estimated parameters were of concern. Consequently, partially reparameterized versions of Gompertz and logistic models with expected value parameters were developed.

Weather based yield forecasts for rice and wheat using non-linear regression techniques

Weather data on temperature (maximum and minimum), relative humidity and total rainfall from the year 1970-71 to 2009-10 have been utilized for model fitting and two years data 2008-09 and 2009-10 used for validation of the model. Crops yield forecast models have been developed for different districts of Uttar Pradesh using weekly weather data. Residuals were obtained from the selected nonlinear models and linear models. Weather Indices (WI) were obtained and WI based regression models were developed using WI as independent variables while character under study such as crop yield as dependent variable for wheat and rice crop. Comparison of forecast models developed through different approaches was done on the basis of RMSE and MAPE. The results indicated that non-linear models based approach provided better models (or at par) for forecasting in the comparison of linear model approach. The performance of these forecasts was judged on the basis of Mean Absolute Percentage Error of forecasts.

Development of crop yield forecasting models using Generalized Autoregressive Conditional Heteroscedastic (GARCH) and Wavelet techniques

Autoregressive Integrated Moving Average with Exogenous variables (ARIMAX) time-series model along with its estimation procedure was studied. Five models at five important stages of wheat growth were developed by including the most important weather variables. The weekly maximum temperature at Crown root initiation (CRI) stage, tillering stage, anthesis stage, milk stage and dough stage and evapotranspiration at CRI stage were used for model development. As an illustration, ARIMAX models were employed for forecasting of wheat yield in Kanpur district of Uttar Pradesh. Comparative study of the fitted models was carried out from the viewpoint of Relative mean absolute prediction error (RMAPE). It was demonstrated that the ARIMAX methodology was able to provide pre-harvest forecasts based on weather variables at various stages of wheat crop growth, starting from CRI stage (21 days after sowing) to dough stage (126 days after sowing).

It was observed that, as wheat crop grew towards maturity, pre-harvest forecasts got closer to actual values.

Autoregressive integrated moving average with exogenous variable-Generalized autoregressive conditional heteroscedastic (ARIMAX-GARCH) methodology was employed for describing volatile data by incorporating the exogenous variables in the mean-model. As an illustration, ARIMAX and ARIMAX-GARCH models were employed for modelling and forecasting of wheat yield for Kanpur district of Uttar Pradesh, India. Comparative study of the fitted models was carried out from the viewpoint of dynamic one-step ahead forecast error variance along with Mean square prediction error (MSPE), Mean absolute prediction error (MAPE) and Relative mean absolute prediction error (RMAPE). The formulae for more than one-step ahead out-of-sample forecasts along with forecast error variances for the fitted ARIMAX-GARCH model were derived analytically by recursive use of conditional expectation. Superiority of ARIMAX-GARCH model over ARIMAX approach was demonstrated for the data under consideration. For the selected ARIMAX-GARCH model, Maximum overlap discrete wavelet transform (MODWT) coefficients were computed for the weekly maximum temperature series at CRI stage for wheat yield time-series data of Kanpur district for forecasting of maximum temperature at CRI stage. After obtaining the forecast of maximum temperature by Wavelet methodology, these forecasts were used for forecasting of wheat yield by the model developed.

A study of stochastic volatility (SV) models through particle filtering

Estimation procedure for fitting SV model proposed by Taylor and SVM model proposed by Koopman and Uspensky has been developed through Particle filtering. Code for the same has also been developed in MATLAB, 2007. Formulae for optimal out-of-sample forecasts for SV model have been derived. The developed estimation procedure for fitting SV model has been applied for modelling and forecasting the volatile India's monthly Basmati rice export data. It has been shown, using appropriate statistical measures, that SV model fitted through Particle filter performed relatively better than GARCH model for modelling as well as forecasting.

Development of methodology for estimation of compound growth rate and its web-based solution

Compound growth rates were estimated in respect of non-monotonic situations for all the three possibilities, viz Over-

damped, critically damped, and under-damped. Code was constructed in R language for estimation of compound growth rate for the above three non-monotonic situations. As an illustration, India's nine oilseeds production data (in Million tonnes) during 1986-87 to 2002-03 was considered.

To assess goodness of fit of the model, Mean Square Error (MSE) were computed. Using the Critically-damped model, the compound growth rate for the nine oilseeds production in India during the period 1986-87 to 2002-03 were computed. Codes were constructed in R language for estimation of compound growth rate using nonparametric methodologies applying (a) Moving average technique under Time Domain approach, and (b) Kernel Smoothing technique for error dependent process under Time Domain approach by using modified plug-in technique. The optimum bandwidth was obtained to estimate time varying growth rate.

Code was also constructed in SAS IML for estimation of compound growth rate by (a) applying local linear kernel smoothing using various bandwidth, and (b) obtaining interval estimate of growth rate based on local linear kernel smoothing.

As an illustration, India's total foodgrain production data (in Million tonnes) during 1960-61 to 2010-11 was considered.

It was observed that the error series was long range dependent. Therefore, a novel approach of iterative estimation of the optimal bandwidth under long range dependence was formulated. The steps were as follows:

- i) Estimate an "optimal" bandwidth \hat{h}_{opt}/T , assuming only short range dependent errors.
- ii) Let $h'_0/T = \hat{h}_{opt}/T$.
- iii) For $j = 1, 2, \dots$ estimate $g(\cdot)$ using h'_{j-1} and let $\hat{X}_i = r_i - \hat{g}_{n'_{(j-1)}/T}(i/n)$. Estimate long memory parameters to compute AIMSE.
- iv) Estimate second derivative of $g(\cdot)$ and denoted by $\hat{g}_2(u, h_2/T)$ where $h_2/T = (h'_{j-1}/T)^{T^{\alpha/(4p+2\alpha)}}$.
- v) Use estimated second derivative of $g(\cdot)$ to finally calculate AMISE over various values of h/T and get optimal h'_j .
- vi) Repeat process (iii) to (v) until convergence is achieved.

Technology forecasting in "Visioning Policy Analysis and Gender (VPAGE)"

Technology Forecasting (TF) tools have been employed to forecast future technological needs and trends in Indian

agriculture. TF and Technology Assessment (TA) have been done with the following tools: Analytical Hierarchy Process, Brainstorming, Cross impact analysis, Fisher Pry/ Pearl, Gompertz and Lotka-Volterra substitution models, Framework Forecasting, Scientometrics and Multi-Dimensional Scaling. The agricultural subdomains/ commodities considered were Plant Breeding and Genetics, Rainfed Agriculture, Fisheries, Cotton and Rice. Implications of frontier sciences viz. Remote Sensing (RS) and Information and Communication Technology (ICT) on agricultural R&D have also been done.

The future technological needs in "Plant Genetics and Breeding" (PG&B) domain for sustainable agriculture have been ascertained by Brainstorming workshop. Scientometric analysis in PG&B of agriculture revealed that India is focusing more not only on subdomains like abiotic and biotic stresses but also on niche areas like bioinformatics, Marker Assisted Selection (MAS), transgenics etc. In rainfed agriculture, Analytic Hierarchy Process (AHP) revealed that priority setting on extension, policy and biophysical sectors came out to be 29%, whereas for socio-economic and technological sectors it was 7%. By Multi-Dimensional Scaling (MDS) approach, it was found that water harvesting and water saving technologies were the best strategies to cope with climate change in the coming years among the different technologies considered. In addition, the study revealed that stability of crops should have highest research priority followed by early maturity, broad adoption, stress resistance and high yield potential in achieving high productivity in rainfed areas. In Fisheries sector, AHP was employed to build a hierarchy consisting of "decision criteria" leading to various "alternative courses of actions/factors" within each of them for achieving the goal of a well-established fisheries sector and the AHP tree thus obtained showed that both 'technological' (with 'fuel saving technologies' alternative carrying highest priority of above 18%) and 'institutional and policy' criteria (with 'infrastructural facilities in fish landing centres' alternative carrying a highest priority of above 13%) contributed 45% each in achieving the set goal while the 'extension' criteria contributed 10%.

The substitution models viz., Fisher-Pry/Pearl, Gompertz and Lotka Volterra models were fitted for data on area under adoption of Bt Cotton in India. It was found that by 2013, if the same trend continues, all of area under Indian Cotton will be substituted by Bt Cotton. Kane's KSIM cross impact simulation model was utilised for inferring about the future behaviour of variables of Indian cotton viz., Production, Export, Import and Supply over time. It

was inferred from the study that if no curb on imports was done then it may increase over time in the long run. A conceptual cum critical TF technique namely, Framework Forecasting was also attempted to study the cotton scenario in future both in the Indian as well as in the global context. While the baseline future envisioned the dominance of Bt cotton in almost all the major countries, the alternative future to Cotton production were also outlined such as plausible options like water resistant, fire resistant, wrinkle free and drought tolerant cottons. For rice, it was found that, if technological needs are fulfilled in low productivity districts, it would lead to an increase of 7% in production. Priority areas for applications of RS on agricultural research and development have been identified. Agricultural extension was one of the dominating applications of ICT over others. Thus, TF and TA tools have been successfully employed to aid decision making in agriculture.

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

Agro-climatic zone-wise trend in temperature and precipitation have been estimated by both parametric and nonparametric methods. Wavelet analysis in frequency domain has been used for detection of trend in rainfall in above zones. It was found that there is significant trend present in all the zones.

Study of asymmetry in retail wholesale price transmission for selected essential commodities

It has been observed that changes in wholesale prices are neither fully nor partially transmitted to consumer prices via retail price. The study indicated that the retail traders are more active and are not following the price signals coming from wholesale traders even in short run. The fall in wholesale price is partially transmitted whereas the rise in wholesale prices is more than fully transmitted to the consumers. In both the situations the retail traders are earning a huge profit from trading. The results of Error Correction Model for Rice markets indicated that there existed persistence asymmetry in marketing of Rice and the extent of asymmetry was more acute in Hyderabad (Rs.1.27) followed by Cuttack (Rs.1.21) and Delhi (Rs.0.99) markets. The lowest extent of asymmetry was found in Amritsar (Rs.0.77) market. For Wheat markets, the results indicated that asymmetry do exist in marketing of Wheat and the extent of asymmetry was more acute

in Chennai (Rs.1.33) followed by Hyderabad (Rs.1.20) and Delhi (Rs.1.01). The lowest extent of asymmetry was found in Bangaluru market (Rs.0.89). For Gram markets, the extent of asymmetry was more acute in Chittoori (Rs.1.18) followed by Bhopal (Rs.1.08), Delhi (Rs.0.99). The lowest extent of asymmetry was found in Sri Ganganagar market (Rs.0.96). For Moong, the extent of asymmetry was more acute in Delhi (Rs.1.16) followed by Kolkata (Rs.1.08). The lowest extent of asymmetry was found in Chennai market (Rs.0.87). In Rape seed & Mustard Oil, the extent of asymmetry was more acute in Delhi (Rs.1.44) followed by Kolkata (Rs.0.94) with lowest extent of asymmetry found in Kanpur market (Rs.0.91). For Sugar trading, the extent of asymmetry was more acute in Hyderabad (Rs.1.49) followed by Delhi (Rs.1.27) and Sri Gaganagar (0.67). The lowest extent of asymmetry was found in Kolkata market (Rs.0.52). In trading of Apples, the extent of asymmetry was more acute in Delhi (Rs.1.02) followed by Lucknow (Rs.0.90) and Chennai (0.86). In trading of Onions, the extent of asymmetry was more acute in Chennai (Rs.1.06), Kolkata (1.03), Mumbai (0.97) and in Hyderabad (0.90). The lowest extent of asymmetry was found in Lucknow market (Rs.0.82). The varying level of asymmetry practically is an indication of market efficiency attained in different markets of the same commodity.

The value of long run adjustment was almost close to zero in all the markets indicating that most of the changes in wholesale markets were already transmitted to consumers in the short run and very little was left for long run adjustments.

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

Secondary data on volumetric statistics on groundwater resources, groundwater table and source-wise irrigated area were collected and analysed. The structure of water markets in North-western Rajasthan was studied. The cropping pattern and productivity of major crops were also examined under different forms of water markets. It was observed that three-fifths of net sown area in North-Western region were irrigated. The region was dominated by canal irrigation. Although, the annual growth in groundwater irrigated area was impressive (14 per cent) during 2000-01 to 2008-09, there was a further scope for groundwater development in the region as its development was 46 and 80 per cent in Sri Ganganagar and Hanumangarh districts in 2009.

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

Farm power machinery use protocol and management for sustainable crop production

For a comprehensive assessment of mechanization and agricultural machinery manufacturing/supply scenario in Punjab and Rajasthan, primary data collection on farm power-machinery and their uses in the selected villages of Ludhiana district of Punjab State has been completed and is in progress in Rajasthan State. Secondary data on population of farm power resources, crop production input uses, mechanization status etc. was acquired. Data analysis of the acquired secondary data was done. The linkages between the research/ educational institutions and the manufacturer of agricultural machinery were studied. Expert system for efficient farm machinery selection is being developed. The flow chart for development of expert system has been prepared.

Small area inference using survey weights

In this era of decentralization, the thrust of planning process has shifted from macro to micro level. The thrust of research efforts has shifted to development of precise estimators for small areas. Small area estimation (SAE) techniques are used to produce reliable estimates for small areas. As a consequence, SAE is now very common in survey sampling, with several methods proposed in the literature. However, research continues on the identification of SAE techniques that are efficient and also simple to implement, with estimation of mean squared error (MSE) a particular problem. Unit level linear mixed models are often used in SAE, and the empirical best linear unbiased prediction (EBLUP) based approach is widely used for producing small area estimates under such models and proven to be efficient. However, this approach of SAE does not make use of the unit level survey weights. As a result, small area estimator based on this approach is not design consistent unless the sampling design is self-weighting within areas. The Pseudo empirical best linear unbiased prediction (Pseudo-EBLUP) approach overcomes this limitation by using sample weights and also leads to design consistent small area estimator.

A bias-robust method for estimating the MSE of Pseudo-EBLUP estimator that remain approximately unbiased under failure of assumptions about second order moments

has been developed. The proposed estimator is based on conditional approach of MSE estimation and provides area specific MSE estimates for the Pseudo-EBLUP. In addition, the conditional approach of MSE estimation leads to estimator of MSE that is simpler to implement, and potentially more robust. In particular, it performed reasonably well overall in terms of estimating true MSE for the Pseudo-EBLUP.

Spatial nonstationarity in small area estimation under area level model

In many Small area estimation (SAE) problems, it is not possible to use the unit level small area model simply because of the unavailability of the unit level data. In such circumstances, SAE is carried out under area level small area models. The Fay-Herriot model (Fay and Herriot 1979) is widely used area level model in SAE. This model relates small area direct survey estimates to area-specific covariates, often obtained from various administrative and census records etc. The SAE under this model is one of the most popular methods used by private and public agencies because of its flexibility in combining different sources of information and explaining different sources of errors. There are situations (for example agricultural, environmental and economic data), where the relationship between variable of interest and covariates is not constant over the study space, a phenomenon referred to as spatial nonstationarity. This area level model does not account for spatial nonstationarity present in the data. A geographically weighted pseudo empirical best linear unbiased predictor (GWEBLUP) for small area means was introduced under geographically weighted version of area level model. In SAE, the mean squared error (MSE) estimates are required for measuring uncertainty or reliability and producing the confidence interval of small area estimates. The MSE of GWEBLUP for small area means was developed, and then asymptotically unbiased estimator of the MSE with the second-order accuracy was derived based on the Taylor series approximation. Empirical studies were undertaken to examine the empirical performance of the proposed MSE estimation method. The MSE estimator of the GWEBLUP appeared to provide good approximation of true MSE along with desirable level of coverage and stability performance.

Study to develop methodology for crop acreage estimation under cloud cover in the satellite imageries

The techniques of simple kriging, stratified kriging, simple co-kriging, stratified co-kriging were applied to remove

cloud in the satellite images. Spatial imputation techniques were evolved for generation of cloud free images based on row-wise pixels, column-wise pixels, both row-wise and column-wise pixels, neighbouring pixels and by ratio and regression approach. Cloud free images were generated using all these techniques and then these techniques were compared by estimating area under paddy crop from the generated cloud free images.

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

Data of Crop Cutting Experiments (CCEs) for different crops (having smaller sample sizes) pertaining to number of States under Improvement of Crop Statistics (ICS) scheme were obtained from NSSO for the agricultural year 2010-11. Estimates of average yield for wheat and paddy crops at State level were obtained with suitable precision, however, for other food grain crops like bajra, gram, black gram, green gram, horse gram, jowar, maize, barley, ragi etc., these were obtained with very high estimates of percentage standard errors. Sample sizes for different levels of margin of errors were worked out for estimation of average yield of different crops. ICS scheme related crop area data for different districts of some States for the agricultural year 2010-11 was analysed. Estimates of area under different crops were obtained with very high estimates of percentage standard errors.

Study to develop an alternative methodology for estimation of cotton production

The estimates of average yield of cotton along with its percentage standard error has been obtained for all the five districts of Maharashtra namely, Aurangabad, Buldana, Aurangabad, Jalna and Jalgaon using the proposed methodology. In the process of exploring other sampling designs, estimation procedure for estimating average yield of cotton using double sampling under stratified two stage sampling framework was also developed. The survey for primary data collection for validation of the developed alternative methodology was planned. Two districts of Maharashtra State namely, Aurangabad and Amravati and two districts of A.P. State namely, Warangal and Guntur were selected for validation. Training for data collection was imparted in both the districts of Maharashtra and A.P. States. Field data collection in both the states has been completed with the help of respective State Govt. officials. Supervision of data collection was done in both the states at regular intervals. The process of acquisition of data from both the

states is in progress. The developed alternative sampling methodology was presented in the National Workshop on Improvement of Agricultural Statistics organized by Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India at New Delhi and the methodology is likely to be adopted in all the cotton growing states of the country after validation as announced in the workshop.

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

In sample surveys, auxiliary information on the finite population is often used to increase the precision of estimators of finite population total or mean or distribution function. In the simplest settings, ratio and regression estimators incorporate known finite population parameters of auxiliary variables. The calibration approach proposed by Deville and Sarndal (1992) is one of the other techniques widely used for making efficient use of auxiliary information in survey estimation. However, in many cases, the population could be spread over a wide area entailing very high travel expenses for the personal interviewers. In addition, efficient supervision of the field work can be difficult, which could result in high non-response rates and severe measurement errors. In such situations, two-stage sampling designs are preferably considered. Different calibration estimators of the finite population total have been developed based on the assumption that the population level auxiliary information is available both at the psu and ssu level under two stage sampling design. The variance of these estimators along with their estimators of variance have also been developed under two-stage sampling design. In particular, twelve different situations of data availability have been considered and estimators have been obtained. The empirical evaluations revealed that all the developed calibration approach based estimators under two-stage sampling design were better than the usual estimator under two-stage sampling design with no auxiliary information.

Impact assessment of agroforestry model in Vaishali district of Bihar State

Impact of agroforestry on socio-economic conditions of farmers of Vaishali district of Bihar State was to be assessed due to the ICFRE agroforestry project launched in the district. Sample selection was done as per the proposed sampling design i.e. stratified two stage sampling treating blocks as strata, villages as first stage units and households as ultimate stage units. Planning

for survey and imparting training to field investigators for primary data collection was done. The designing of schedules for primary data collection was done. The designed schedules were finalized. Testing of the designed schedules was done in the field during a visit to Forestry Research and Extension Centre (FREC), Patna and Vaishali district by IASRI officials during 15-22 January, 2013. The schedules were modified after testing in the field and were translated in Hindi language. Training (class room as well as in the field) to field investigators for data collection was imparted using Hindi version of schedules. Supervision of data collection was done and doubts of field investigators in collection of data and filling the schedules were clarified. Second round of supervision was done by IASRI officials during 11-17 March, 2013.

Small area estimation for skewed data

In many surveys, e.g. agricultural, environmental and business surveys, data are typically skewed and linear model assumptions are questionable. Commonly used methods for small area estimation are based on the 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. In particular, empirical best linear unbiased prediction (EBLUP, Prasad and Rao, 1990) and model-based direct (MBDE) estimation (Chambers and Chandra, 2009) are typically based on linear model assumptions. However, when the data are skewed, the relationship between Y and X may not be linear in the original (raw) scale, but can be linear in a transformed scale, e.g. the logarithmic scale. In such cases estimation based on a linear model for Y is expected to be inefficient, and an appropriate technique for small area estimation should then be based on a linear mixed model for a transformed version of Y . The use of transform variable based estimation was explored when carrying out small area estimation for skewed data, focussing on the widely used log-log transformation. An empirical best predictor for small area means, in the sense that it has minimum mean squared error in the class of unbiased predictors, has been developed. The proposed method is expected to be more efficient than the existing methods of small area estimation for skewed data.

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

Sampling frame for selection of districts, blocks and villages for the study was prepared using Census 2001

data. Selection of 120 districts for the study, 2 blocks from each selected district and 5 villages from each selected block was done. The schedules and instruction manual for primary data collection in all 120 districts were finalized. An orientation meeting was held at Agricultural Research Station, Durgapura, Jaipur in which training for primary data collection and enquiry based data entry software was imparted to the Research Engineers and Principal Investigators under AICRP on Post Harvest Technology. The updation of observation based data entry software was done. An Orientation meeting was held at CIPHET, Ludhiana in which training for updated observation based data entry software was imparted to the Research Engineers and Principal Investigators under AICRP on Post Harvest Technology.

Calibration based product estimator in single and two phase sampling

Auxiliary information is often used by survey statisticians to increase the precision of estimators of commonly used parameters. Some examples of estimators of population mean or population total, which use auxiliary information, are ratio and regression estimators. The ratio estimator, in particular, is useful when there is positive correlation between the study and the auxiliary variable. However, in many practical situations, the study and the associated auxiliary variable are negatively correlated. In these situations, the product estimator, developed by Murthy (1964), is a viable alternative. A new product estimator has been proposed using the calibration approach under the assumption that a negative correlation exists between the study and the auxiliary variable. In addition, expressions for bias, variance and variance estimator of the proposed calibration approach based estimator have also been developed. The calibration approach was used a second time on the variance estimator of the proposed estimator for further improvement in variance estimator. Empirical evaluations showed that the developed methodology was reliable and stable alternative to traditional product estimator for estimation of population parameters.

Estimation of finite population total using calibration based regression type estimator for inverse relationship between study and auxiliary variable

The ratio estimator is widely used for estimation of finite population mean or total when the study and the auxiliary variable have positive correlation and their regression line passes through origin. However, in real life data, the study

and the associated auxiliary variable are sometime negatively correlated. In this case, the product estimators discussed in Murthy (1964) and Sud *et al.* (2013) can be applied for estimation of finite population total. These estimators are highly biased if the fitted regression line between study and the associated auxiliary variable does not pass through origin. For such cases, a regression type estimator has been developed using the calibration approach under the assumption that a negative correlation exists between the study and the auxiliary variable and the regression line does not pass through the origin. The expressions for bias, variance and variance estimator of the new estimator have also been obtained. The improved performance of the proposed estimator over the usual regression estimator is demonstrated through a simulation study. The double sampling approach based calibrated estimator has also been dealt with for the situation when the auxiliary information is not available. The improved performance of the double sampling based calibration estimator over the usual regression estimator, in terms of the criterion of mean square error of the estimator, is also demonstrated through a simulation study.

Construction of food security index

Sub-indices of Food Security Index (FSI) were constructed for all the three states namely, U.P., Bihar and Punjab. Thematic maps were generated based on constructed FSI and their sub-indices for all the three States using Geographic Information System (GIS).

Sample Survey Resources Server

Sample Survey Resources Server, hosted at www.iasri.res.in, is a web resource created with a goal to disseminate research in theory, application and computational aspects of sample survey among (i) the statisticians in academia, (ii) the practicing statisticians involved in advisory and consultancy services, (iii) scientists in the National Agricultural Research System, and (iv) 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 analyzing the complex survey data generated.

An important feature of this web resource is that it provides an online calculator for the determination of sample size for estimating the population mean or population proportion for simple random sampling without or with replacement sampling design. An exhaustive list of books on sampling theory is also available on the server. Lectures on glossary of sampling theory, fundamentals of survey sampling and small area estimation under area level model along with the R code for analysis of data serve as E-learning material for the readers. Other links useful for survey statisticians are also available at this resource.

Among the other important features of the web resource is the link "Ask a Question" through which the user can ask questions and seek clarifications through Email. This link is partially in operation and needs to be further strengthened.

It is expected that the material provided at this server would help the survey practitioners in general and in agricultural sciences in particular and those survey practitioners involved in planning, designing and analysis of large scale complex surveys in the national statistical system in improving the quality of research in their respective sciences and making their research globally competitive.

A snap shot of the web resource is given below:



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. The Agricultural Research Data Book (ARDB) 2012, which is the fifteenth in the series, is an attempt to put together main components/indicators of such information. The Data Book comprising 172 Tables is organized, for the purpose of convenience of the users, into ten sections namely, Natural Resources; Agricultural Inputs; Animal Husbandry, Dairying and Fisheries; Horticulture; Production and Productivity; Agricultural Engineering & Produce Management; Export & Import; India's Position in World Agriculture; Investment in Agricultural Research & Education; and Human Resources under National Agricultural Research System (NARS). This edition contains latest information / data as available in the country by the end of May, 2012. In ARDB 2012, 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 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 and since then, it has been brought out every year.

Visioning, Policy Analysis and Gender (V-PAGe) (Sub-Prog. III): Policy analysis & market intelligence (NAIP Project)

Under agricultural commodity futures, trade, the futures and spot prices of soybean in NCDEX exchange were found to be cointegrated and sharing a long run relationship. There is a causality flow from futures markets towards spot markets indicating information flow from futures to spot markets. At the same time, there is also a reverse information flow happening in case of August-2008 and June-2009 contracts signifying price discovery in both futures and spot markets. This finding to a large extent answers to the apprehensions about the destabilizing impact of commodity futures markets in India. The investigation into potato farmers' participation in future markets revealed that there is a scope for farmers for participating in commodity markets as their marketed surplus is higher and if the cold storage owners can be used as agency for financing, providing reliable market intelligence and quality and quantity certification. The

hypothecation of commodities in the warehouse should be treated towards margin to facilitate farmers' participation in futures market.

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

Study of synonymous codon usage and its relation with gene expressivity in genomes of halophilic bacteria

Codon selection pattern was studied in three different organisms which inhabit different habitats. This study helped in exploring the factors which were governing codon selection pattern of these organisms. It also provided an insight into gene expression level of these organisms.

From the findings, it was suggested that in all the three bacterium isolated from moderate, low and high halophilic conditions, there were a large number of genes with high G+C content, and G+C content at the third codon position is higher than that of A+T. Accordingly, it was suggested that the usage frequency of codons ending with G or C bases was higher than that ending with A or T bases. High level of heterogeneity was seen within the genes of various functions in all the organisms. It was observed that in all cases, codon usage was largely determined by compositional constraints. Translational selection also seemed to affect shaping the codon usage variation among the genes. Therefore, the variation in codon usage among the genes might be due to mutational bias at the DNA level and natural selection acting at the level of mRNA translation. Length of the genes also affected the codon usage bias, while aromaticity and hydrophobicity of the encoded proteins played minor role in shaping codon usage bias.

Blastn was used for finding similarity between highly expressed genes of *S. ruber* and all the gene sequences of *C. salexigens*. For this, the highly expressed gene sequences of *S. ruber* were used as a query against database containing all the sequences of moderately halophilic bacterium, *C. salexigens* and also against sequence database of non-halophilic bacterium, *Rhizobium*. Blastn ended with no sequence similarity in these organisms. It may be inferred that the functional aspects of all the genes in extremely halophilic, moderately halophilic and non-halophilic organisms are diverse and thus the similarity in their genes could not be recorded.

Agriculturally important microbes such as Rhizobium, Azotobacter etc. are helpful for increasing soil fertility, nitrogen fixation and are used as biofertilizers.

Knowledge of optimal codons might provide more useful information for gene engineering and/or evolution studies related to nitrogen fixation. The findings may facilitate in developing bio-fertilizers for improving soil fertility if expression of these identified genes was induced in case of non-symbiotic bacterium. Further, identification of salt-tolerant genes in halophilic bacteria and transfer of such genes to other agriculturally important bacteria will help them to adapt under conditions of salinity environment. Inoculation of these bacteria with salt-tolerant characteristics in in-vivo condition may facilitate the enhancement of crop productivity.

Algorithm for gene classification based on gene expression data

The gene expression data of chickpea under abiotic stress was obtained and the consensus clustering was applied on it that identified the co-regulated genes. Customization of penalized classifier called Least Absolute Shrinkage and Selection Operator (LASSO) using kernel function was done. Code of customized classifier has been written in MATLAB and applied to gene expression data of Arabidopsis thaliana (Model Plant). Accuracy of the developed model has been tested through Leave One Out Cross Validation technique.

Agriculturally important plants suffer from different abiotic stress conditions like draught, salinity, temperature and biotic stresses like different diseases. Classification of genes according to different abiotic and biotic stress will be of great help in genetic engineering and breeding program to develop the varieties which may be able to survive in stress conditions.

Analysis and determination of antimicrobial peptides: A machine learning approach

A database of the antimicrobial peptides for cattle collected from various source like APD2, CAMP, AMSDB, DAMP etc. and published literature was developed using PHP and MySQL. It is available at <http://cabindb.iasri.res.in/amp/database.html>. Analysis for N and C terminals were done for AMPs followed by occurrence of all 20 natural amino acids at both termini. It was observed that at N terminal, residues like R, L and C were more preferred while at C terminal, residues like R, K and C were more preferred. Thus, it can be concluded that both termini preferred more of positively charged residues. The dataset was further analyzed and prediction

models using Artificial Neural Network for classification of antimicrobial peptides were developed with accuracy of 94.95.



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

In India, grape cultivation is concentrated in the semi arid region and a number of factors like unpredictable rains, poor irrigation, water quality, excessive use of fertilizers etc. adds to the already prevalent saline soil conditions leading to decline in productivity. The understanding of salinity stress will be greatly enhanced by elucidating the structural and regulatory genes responsible for developmental and physiological processes under stress response. With this objective, a total of 16785 salt stress Expressed Sequence Tags (ESTs) of *Vitis vinifera* were extracted from public domain. 1201 contigs were assembled to be taken for BLAST, mapping, annotation along with the domain identification using BLAST2GO tool. The identified 243 contigs were taken individually to Phytozome v 8.0 for BLAST followed by Fgenesh to predict the genes. 21 genes were found and 7 classes of transcription factors (Dof, GATA, ARF, ERF, MYB, RAV and WRKY) were detected in the identified genes.

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

An *in silico* approach was followed to identify the key residues of Mn-SOD that regulate the salt stress tolerance, across species. A total of 22 species including microbes, fishes, animals and plants were selected for this study

and the tertiary structures of the Mn-SODs were predicted through homology modelling whose three dimensional structures were not available in PDB. The predicted structures were submitted at PMDB, which were further accepted. The residues conserved throughout species were then identified from sequence alignment and further their conservancy was studied both at structural and functional level. The residues thus found to be conserved are reported as the key residues that play a significant role in salt stress tolerance mechanism in terms of contribution to the cofactor and substrate specificity, active site gateway formation and protein stability.

Low temperature tolerance is a desired trait for rice grown in North Eastern hill region of India. Efforts to find newer and/or better alleles for this abiotic stress has led to identification of Single Nucleotide Polymorphisms (SNPs) across the ORFs of transcription factor DREB (Dehydration Responsive Element Binding protein) viz. DREB1A and DREB1B induced in response to low temperature in upland genotype UR14. Domain analysis of DREB1A and 1B revealed that the proteins has a DNA binding domain (AP2) but the SNPs do not lie on it, which reflect that the SNPs might not affect the main function of the protein. In order to verify this fact at structural level, tertiary structures of DREB proteins (both normal and with SNP) have been predicted by fold recognition method and validated by standard procedures.

The analysis of phenotypic data received from one of the consortium centres highlights the prevalence of wide spectrum of genetic variability across SSILs and STILs that could be a potential repository for dissecting the molecular basis of salinity stress responses.

Whole genome association analysis in complex diseases: An Indian initiative

Whole genome SNP data for Ulcerative colitis diseases was analysed by Least Absolute Shrinkage and Selection Operator (LASSO) and Random Forest (RF) to identify SNPs associated with the trait. The performance of the LASSO, RF vis-a-vis Support Vector Machines (SVMs) for prediction of disease status was assessed through prediction metrics.

Identification and characterization of genomic sequences responsible for salinity-stress in cereal crops-rice, sorghum, maize and wheat

Under this study, 116242 expressed sequence tags (ESTs) were downloaded, clustered and assembled into 11042

contigs after pre-processing the ESTs by removing the polyA/polyT tail. Biological functions were assigned to 11000 contigs through Gene Ontology (GO) and the remaining contigs showed no functional assignment. The remaining contigs were mapped on to maize chromosomes and full length gene sequences were designed. Altogether, 9 such genomic region were obtained, with TSS (transcription start site), PolyA tails at the extremes ends and CDS (coding sequences) in between, as novel candidate genes. These designed candidate genes were further validated by means of promoter analysis.

Computational identification of putative miRNAs and their characterization in *Heliothis virescens*

ESTs of *Heliothis virescens* and miRNA of insect species has been downloaded from miRBase. A BLAST search has been carried out between these. These searches have been filtered by applying various criterions. Sliding windows concept has been applied and then the secondary structures of these sequences have been found using RNAfold program. MiPred software is used for the classification of real precursor from pseudo precursor sequences. Targets of these have been found using MiRanda program. Four novel putative miRNA were identified from *H. virescens* from ESTs sequences based on homology search. Their targeted proteins were also identified. These findings also strengthened the bioinformatics approach for new miRNAs identification from insect species whose genome was not yet sequenced. The ESTs based identification also confirmed the miRNAs expression. This approach holds great promise for the future as it allows a wide range of potential targets for suppression of gene expression in the insect. Additional genetic /molecular studies will be needed to understand whether miRNAs typically regulate only a handful of key targets or co-ordinately regulate multiple targets which are equally important.

Gene expression analysis using synonymous codon usage analysis for *Drosophila*

Coding sequences of *Drosophila* having Cytochrome P450 mono-oxygenase had been downloaded from NCBI site. Various Codon Usage Indices have been calculated and multivariate analysis has been done to establish differential level of expressions and the pattern of synonymous codon usage of CYP genes in *Drosophila*. This study was helpful in understanding P450s enzyme system involved in

resistance mechanism. The main objective of this study was to apply synonymous codon usage bias to understand the expressivity level of different categories of resistant genes in model insect. This study also helped to develop new strategies to mitigate the insecticide resistance development in pest insects which was serious concern for agriculture and human health.

In-silico identification of genes responsible for late blight disease in potato

The virulent and susceptible genes were identified and information was sent to CPRI, Shimla. Based on the findings of this study a new inter-institutional project with NBPGR and CPRI has been initiated.

Programme 5: DEVELOPMENT OF INFORMATICS IN AGRICULTURAL RESEARCH

Strengthening Statistical Computing for NARS

Strengthening Statistical Computing for NARS (www.iasri.res.in/sscnars) targets at providing

- research guidance in statistical computing and creating sound and healthy statistical computing environment and
- providing advanced, versatile, innovative and state-of-the-art high end statistical packages for analysis of data so as to enable drawing meaningful and valid inferences and converting research output into knowledge

The efforts also involve designing intelligent algorithms to implement statistical techniques particularly for analyzing massive data sets, simulation, bootstrap, etc. Capacity building, achievements, usage and impact is summarized in the sequel.

Capacity Building

- 211 researchers have been trained on Data Analysis using SAS through 11 training programmes of one week duration each. With this the number of researchers trained has gone upto 1883 through a total of 91 training programmes. Out of these 11 training programmes in 2012-13, 02 were organized by IASRI, New Delhi and rest 09 by consortium partners. 04 were organized at doorsteps of the users such as RVSKVV, Gwalior; SKRAU, Bikaner, NIRJAFT, Kolkata and VPKAS, Almora. 03 of these 11 training programmes were on specific topics such as Design of Experiments, Sample Surveys and Multivariate Analysis.



- 40 researchers were trained through two training programmes on (i) Analysis of Design of Experiments using SAS and (ii) Biometrical Analysis using SAS organized by Nodal Officer from IGKV, Raipur.

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 (SAS EAS 9.3, JMP 10, JMP Genomics 6.1 and all products for 64 bit windows) and to have a face to face interaction with nodal officers, third Workshop-cum-installation training programmes at 09 Statistical Computing Hubs were organized.
- The Workshop-cum-Installation training at IASRI was organized during 25-26 June, 2012. Dr. S Ayyappan, Secretary DARE and Director General, ICAR inaugurated the Workshop. Bulletin on Indian NARS Statistical Computing Portal was released during the occasion.
- The software has been installed on 2095 computers (1623 reported earlier) in all 151 NARS organizations (on an average 13 machines per NARS organization). SAS Genetics successfully installed in Thin Client Environment at Statistical and Computational Genomics Laboratory, IASRI, New Delhi.

Strengthened Indian NARS Statistical Computing Portal

- Indian NARS Statistical Computing Portal (<http://stat.iasri.res.in/sscnarsportal>) has been strengthened by adding 13 new modules of analysis of data generated from Completely Randomized Designs, Resolvable Block Designs, Row-Column Designs,

Nested Block Designs, Split-Split-Plot Designs, Split Factorial (main A, sub B x C) Designs, Strip Plot Designs, Response Surface Designs, Univariate Distribution Fitting, Test of Significance based on t-test and Chi-square test, Discriminant Analysis, Correlation and Regression Analysis. The data can be analysed by uploading *.xls, *.xlsx, *.csv and *.txt files.



Macros for customized analysis and E-reference manuals

- For customized analysis, macros for analysis of data generated from Strip Plot Designs have been developed and made available on the project website <http://www.iasri.res.in/sscnars/StripPlot.aspx>.
- Following 04 reference manuals consisting of 52 lectures have been uploaded on project website:
 - Genetics/ Genomics Data Analysis Using SAS: 14 lectures
http://www.iasri.res.in/sscnars/content_Genetics.htm
 - Data Analysis in Social Sciences Research Using SAS: 19 lectures
http://www.iasri.res.in/sscnars/content_social.htm
 - Data Mining Using SAS: 11 lectures
http://www.iasri.res.in/sscnars/content_dm.htm
 - Data Analysis Using R: 08 lectures
http://www.iasri.res.in/sscnars/content_rmanual.htm

Sensitization of researchers

- Website of the project is being maintained and updated regularly. During 15 November, 2010 – 31

March, 2013 Google analytics gave 21900 page views across 367 cities of 71 countries. During 01 April, 2012- 31 March, 2013, there were 11747 page views across 322 cities of 66 countries. Average time on page was 3.18 minutes.

- With the cooperation and support from CRIDA, Hyderabad and NAARM, Hyderabad, first in-house Webinar session was conducted. The participants were given the exposure of Design Resources Server and Indian NARS Statistical Computing Portal. Second in-house WebEx session was conducted on 16 February, 2013.
- WebEX session on JMP Genomics 6.0 and JMP DOE were also arranged.
- To sensitize the researchers about the availability of this high end statistical package, 336 participants were sensitized through 12 sensitization training programme-cum-workshop organized at NBAIM, Mau; Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut; ICAR RC NEHR Regional Station, Gangtok Sikkim; Assam Agricultural University, Khanpara; College of Agriculture, Bapatla, ANGRAU; TANUVAS, Chennai; ICAR RC ER, Patna; NDRI, Karnal; MPUAT, Udaipur; CIFE Mumbai and Directorate of Onion and Garlic Research, Pune.
- 313 scientists have been sensitized on Statistical Computing through FOCARS by NAARM, Hyderabad (a total of 571 scientists were sensitized).
- Several researchers were also sensitized through the sensitizations programmes conducted by Nodal Officers at NBPGR, New Delhi; NCAP, New Delhi; Junagarh Agricultural University, Junagarh and IISR, Lucknow.
- Presentations were made in 13 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 of research papers in the high impact factor journals. Researchers have started making effective use of the software.

- Based on feedback received from NARS organizations, 105 research reports (98 reported earlier), 201 research papers (100 reported earlier) have been published/ accepted for publication by analyzing the data using high end statistical computing facility; 143 students (60 reported earlier) have used

this in their dissertations; 1229 students (984 reported earlier) have used in their course work. The number of data sets analyzed is more than 3420 (1589 reported earlier) across NARS.

- Reference manual cited in Journal of Doctoral Research in Economics, The Bucharest Academy of Economic Studies. Macro for augmented designs cited by Jennifer Kling, Oregon State University in Introduction to Augmented Designs; Ir. Suprayogi from Laboratory of Plant Breeding and Biotechnology, Central Java, Indonesia and Ogbonna Alex C. from National Root Crops Research Institute, Umudike, Nigeria.
- Number of hits at Indian NARS Statistical Computing Portal since 01 April 2011: 41097.
- Nodal officer from CMFRI, Kochi reported saving of 20 man months in compilation of data related to Marine Fish Household Census 2010 consisting of 10 lakh households with 16 attributes.

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

IASRI is implementing a robust and flexible MIS & FMS System which includes solution for Financial Management, Project Management, Material Management, Human Resource Management and Payroll at ICAR with the funding support from NAIP. A contract agreement was signed on 19 January 2012 between IBM and IASRI on behalf of ICAR to implement the ERP solution based on Oracle Application R12. Business Process Owners and core team members were identified at ICAR and in different institutions in different functional areas.

- Requirement study was carried out in collaboration with ICAR headquarters and partner organizations, and Requirement analysis workshop was organized at IASRI. Based on the requirement study, AS IS documents which cover the current process followed in ICAR institutions have been prepared in the functional areas of Financial Management, Project Management, Material Management, Human Resource Management and Payroll. Six AS IS documents have been prepared in different functional areas.
- Development /System Demonstration Instance of Oracle application was installed and configured for system design and development of TO BE Process

Scenarios. TO BE Design Documents were created in all functional areas based on solution mapping on Oracle Application. Six TO BE documents have been prepared.

- Technical Architecture document which included recommendation for Production and Non-Production hardware along with infrastructure and bandwidth requirements was finalized.
- Web site for MIS/FMS system was created and all the documents related to system are accessible from website.
- System Design and Technical Development (Reports, Customizations) were developed in each functional area of FMS/MIS system. System design along with reports were demonstrated with core business process owners in iterative manner in different meetings. Based on the feedback, the system was strengthened.
- Integrated solution was demonstrated to the Core Team and Business Process Owners in the workshops organised and the feedback received from Business Process Owners was addressed.
- Templates for data collection have been prepared in different functional areas for data digitization related activity. Data digitization awareness workshop was carried out at IASRI. Data digitization teams have been formulated at Phase 1a institution along with some other ICAR institutions. Sample Data (10% for UAT) is being entered in the templates by Phase 1a institutes.



Inauguration of the Requirement Analysis Workshop for ICAR ERP System



AS-IS,TO-BE and Technical Architecture documents related to system



Web site for MIS/FMS system at <http://www.iasri.res.in/misfms>

Establishment of National Agricultural Bioinformatics Grid in ICAR (NABG)

Genomic Database, Portal for genome sequence submission, Cattle genomic resource information system, Crop stress responsive gene Database, Micro-satellite databases of Pigeonpea, Micro-satellite databases of Buffalo have been developed. Four research papers have been published and two accepted in high impact factor journals from the outcome of this project during the period under report. Numbers of research articles are in pipeline for publications. Three research projects have been initiated on the basis of outcome of the research studies in this project and number of inter-institutional research projects including externally funded projects have been initiated. Also, during this year, scientists were working on eight different research studies.

Genomic Databases Developed

A cattle genomic resource information system (CGRIS)

The system is being updated with the identified 4000 additional SNPs, related to different diseases, growth traits and immunity. The database was updated with a new module on *Epitope Vaccines* that contains 175 predicted epitopes for diseases like FMD, BVD, IBR and Calf Scour. An interactive Jmol viewer was designed to visualize the structures of epitopes.

PIPEMicroDB: Microsatellite database and primer generation tool for pigeonpea genome

(<http://cabindb.iasri.res.in/pigeonpea/>)

Molecular markers play a significant role for crop improvement in desirable characteristics, such as high yield, resistance to disease and others that will benefit the crop in long term. *PigeonPEa Microsatellite DataBase (PIPEMicroDB)* is an automated primer designing tool for pigeonpea genome, based on chromosome wise as well as location wise search of primers. This stores 123387 STRs extracted *in silico* from pigeonpea genome. This tool enables researchers to select STRs at desired interval over the chromosome. Further, one can use individual STRs of a targeted region over chromosome to narrow down location of gene of interest or linked QTL. These marker searches based on characteristics and location of STRs is expected to be beneficial for researchers/molecular breeder for varietal improvement.



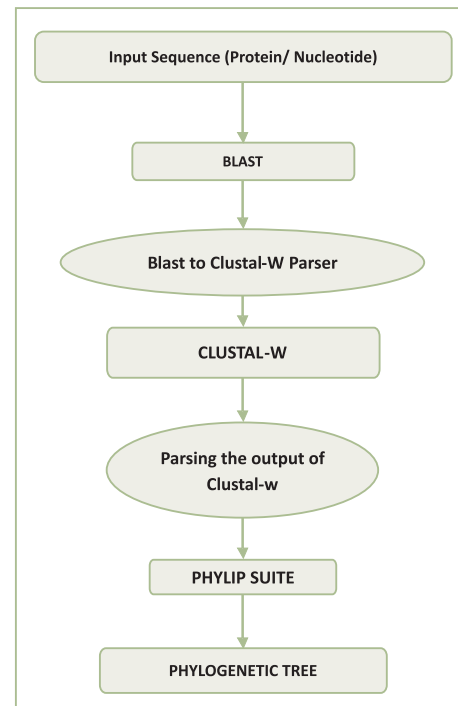
BuffSatDb: Micro-satellite databases of buffalo

(<http://cabindb.iasri.res.in/buffsatdb>)

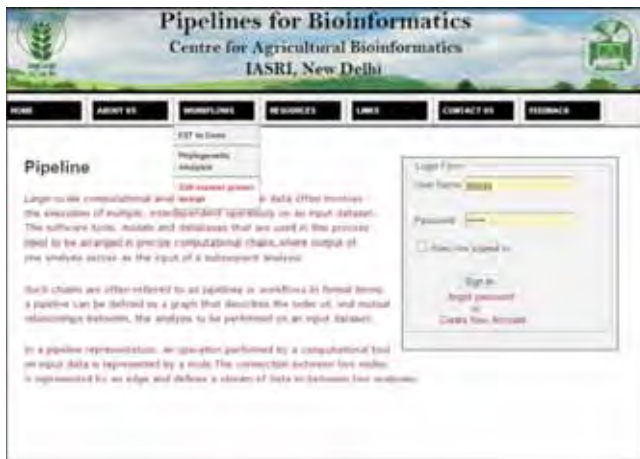
Though India has sequenced water buffalo genome, its draft assembly is based on cattle genome BTau 4.0. Thus de novo chromosome wise assembly is a major pending issue for global community. The existing radiation hybrid of buffalo and these reported STR can be used further in final gap plugging and “finishing” expected in de novo genome assembly. QTL and gene mapping needs mining of putative STR from buffalo genome at equal interval on each and every chromosome. Such markers have potential role in improvement of desirable characteristics, such as high milk yields, resistance to diseases, high growth rate. The STR mining from whole genome and development of user friendly database is yet to be done to reap the benefit of whole genome sequence. By in silico microsatellite mining of whole genome first STR database of water buffalo, BuffSatDb (Buffalo MicroSatellite Database) have been developed which is a web based relational database of 910529 microsatellite markers, developed using PHP and MySQL database. Microsatellite markers have been generated using MlroSATellite tool. The search may be customised by limiting location of STR on chromosome as well as number of markers in that range. This was a novel approach and not been implemented in any of the existing marker database. This database has been further appended with Primer3 for primer designing of the selected markers enabling researcher to select markers of choice at desired interval over the chromosome. The unique add-on of degenerate bases further helps in resolving presence of degenerate bases in current buffalo assembly.



Development of script for automatic download of genomic sequences is in progress. However, a script has been developed for automatic downloading the sequence from the NCBI website using “ftputil” program as a standalone version. Script for degenerate bases of the uploaded sequence has been developed. It can also handle multiple sequences. Also, program has been developed for extraction of sequences from the uploaded input sequence file in which multiple sequences are present. A linked hash map has been used for this purpose. Further, development of framework for the pipelines phylogenetic analysis and SSR-primer is completed. Integration of MISA in the SSR-primer workflow has been done. It handles multiple sequences and shows the result on web. Bioinformatics tools, available for parallelized platform, required for development of pipelines are being explored and downloaded for integration. Various tools for phylogenetic analysis have been reviewed and tools for SSR markers generation and primer designing identified. Designing of home page for the workflows has been done. Web pages for user profile generation and log-in page have been developed.

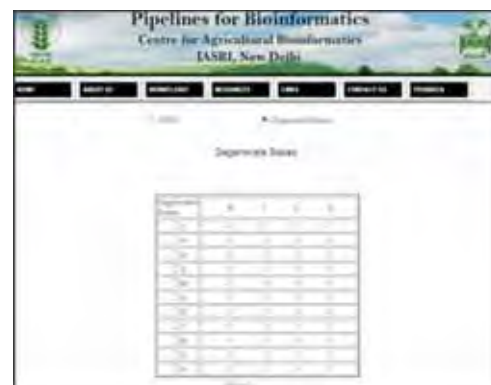


Phylogenetic Analysis Workflow diagram



Home page of the Workflow

Program has been developed for uploading the sequences on the server. Development of script for automatic download of genomic sequences is in progress. Integration of MISA in the workflow has been done. It handles multiple sequences and shows the result on web. Bioinformatics tools, available for parallelized platform, required for development of pipelines under the project are being explored and downloaded for integration.



SSR-Primer Design Workflow diagram

Web based software for codon usage analysis for gene expression identification

This study aims at development of a comprehensive web solution for synonymous codon usage analysis for gene expression identification using client-server architecture. Review of literature has been done. Software has been developed using JSP, NetBean, HTML and JavaScript. Various modules have been developed for the generation of base indices, GC3 Contents, A3, T3, G3 and C3 contents, Codon Bias Index, Codon Adaption Index, Frequency of Optimal Codons (Fop) of codon usage bias data reduction technique like correspondence analysis in codon usage analysis with respect to software development. Web based calculation of codon usage indices would help researchers to calculate these indices using any standard browser.



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

Project Information & Management System of ICAR (PIMS-ICAR) designed, developed and implemented at IASRI, New Delhi at <http://pimsicar.iasri.res.in/> to help in taking decisions to check duplication in research projects both at divisional as well as inter divisional level of ICAR. PIMS-ICAR has also been integrated with Half Yearly Progress Monitoring of Scientists (HYPM) system developed and implemented for all the ICAR institutes. The integration has facilitated the visibility of Research Projects details of ongoing projects with respective PIs and Co-PIs in HYPM. As per the data entry status available in PIMS-ICAR, the ICAR institutes have initiated project data entry process for more than 5550 ongoing and 5656 completed projects into PIMS-ICAR from their respective institutes. The RPF-III of 4024 projects has already been uploaded by institutes and is available in PIMS-ICAR.

Besides, PIMS-ICAR has been included in the curriculum of the training programmes like FOCARS, MDP, EDP and Refreshers courses organized by NAARM, Hyderabad. For hands-on exercise by the trainees, the training demo version of PIMS-ICAR software has been installed on the LAN server of NAARM, Hyderabad.

National Information System on Agricultural Education Network (NISAGENET)

The NISAGENET web portal is being maintained at the Central Server of IASRI, New Delhi and is accessible at <http://www.iasri.res.in/Nisagenet/>. The system is operational in all 65 Universities/Organizations' involved in imparting higher agricultural education in the country. The database of this system contains the information on various aspects such as Academic data of the universities, Infrastructural facilities, Budget provision, Manpower employed, Faculty and R&D activities. Moreover, it has an exhaustive Query/Reports system to provide information at Country, State, University and College levels. To maintain the NISAGENET system and to initiate data management activities from all agricultural universities, Regular contact and Technical Support is being maintained with the Nodal Officers for collection and entry of updated data. The data with regard to faculty status during the year 2010-11 and 2011-12 of the constituent/affiliated colleges is being uploaded by the respective AUs/Colleges. To expedite data management activities from AUs, 3 Appraisal cum Data Validation Workshop, for the Nodal Officers of NISAGENET were organized at SKUAST Jammu, TANUVAS Chennai and Banaras Hindu University, Varanasi respectively. A Workshop on NISAGENET for Associate Nodal Officers of ANGRAU was also organized by ANGRAU at College of Agriculture, Bapatla. As per requirement of the Education Division, ICAR report module has been strengthened to generate the following additional reports:

- Discipline wise reports on faculty members at universities/colleges in the country.
- Reports on experimental farm area at universities/colleges in the country.
- Reports on discipline wise intake capacity, enrolment and passed out students at Masters and Doctoral level in Agricultural Statistics, Statistics, Biostatistics, Bioinformatics and Computer Applications in NARS.
- Reports on Diploma and Certificate courses offered at universities/colleges in the country.
- Reports on State wise distribution of universities/colleges in the country.

- Reports on the universities/colleges that will qualify to celebrate their Silver/Golden/Platinum Jubilee in the 12th Five Year plan.

Half-Yearly Progress Monitoring System of the Scientists in ICAR (HYPM)

For Half-Yearly Progress Monitoring (HYPM) of the Scientists in ICAR <http://hypm.iasri.res.in> was implemented from 01 April 2012 for online submitting the proposed targets by the scientists for the first half year period (01.04.2012 to 30.09.2012). The system facilitate to enter proposed targets for the coming half year and achievements of the completed half-year with respect to Research, Teaching, Training, Extension and Other Prioritized Activities independently.

The Reporting Officer has access to the Proposed Targets and Achievements details submitted by all concerned scientists to add his/her remarks and give recommendations on the basis of the progress reports/inputs submitted by the concerned scientists. Reviewing Officer has dual facilities as he/she may be the Reporting Officer for some scientists like Head of Divisions and Reviewing Officer for other scientists. The Reviewing Officers are able to add their own assessment remarks and final overall grading on the Proposed Targets and Achievements of all scientists. For monitoring progress of the scientists at DG/SMD/ICAR level, various reports are generated for the proposed targets status as submitted by the scientists and comments of the Reporting/Reviewing Officers. HYPM has been included in the curriculum of the training programmes like FOCARS, MDP, EDP and Refreshers courses organized by NAARM, Hyderabad. For hands-on exercise by the trainees, the

training demo version of HYPM software has been installed on the LAN server of NAARM, Hyderabad. The access of HYPM (<http://hypm.iasri.res.in>) is made available to all Institutes/ Bureaus/ Directorates/NRCs for on line submission of the achievements of completed half yearly period – I (01-04-2012 to 30-09-2012) and simultaneously proposed targets of half year period – II (01-10-2012 to 31-03-2013). Provided help and guidance to the Nodal officers for customization & implementation of HYPM from their respective institutes.

Exploration of Central Data Warehouse (CDW) for Knowledge Discovery

The prototype for developing OLAP cubes in SAS OLAP Studio with the help of SAS Enterprise Guide using NSSO data (61st Round) has been developed. Data preprocessing and data preparation for carrying out classification and association task was done. Integration of different data tables to include variables to prepare data for carrying out classification and association rule mining task was done. Data from 3 districts (Faridabad, Sonipat and Rohtak) of Haryana was classified. Association rule mining has been carried out on one district (Faridabad) of Haryana.

ePlatform for seed spice growers

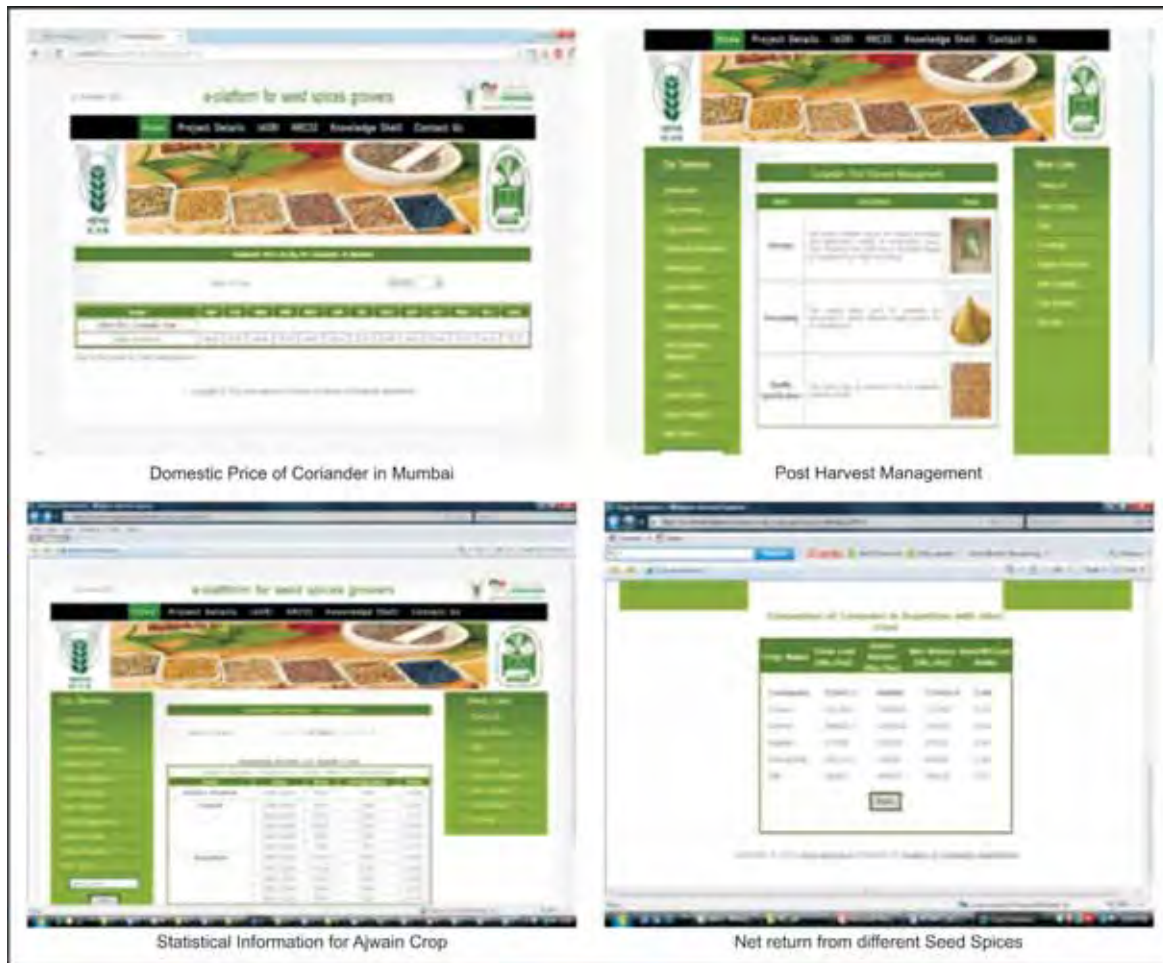
This system is envisaged to provide guidance and information on economic issues related to seed spices. It will also provide the cost benefit ratio of each seed spice based on the area, agro climatic conditions and the factors relevant to crop production. It will project the spice that brings better return to a farmer and henceforth will help in identifying the right crop to be produced by him.

The data submission status of the achievements of Half Yearly Period (01-04-2012 to 30-09-2012) by the Scientists, Reporting and Reviewing officers

No. of Institutes Registered with HYPM (Password Issued to PME Cell I/Cs)	Scientist Registered with HYPM	Scientist Submitted Target	Scientist Submitted Achievement	Reporting Officer Commented	Reviewing Officer Reviewed
97	4487	3981	3948	3800	3602

The data submission status of the online proposed targets of Half Year Period (01-10-2012 to 31-03-2013) by the Scientists, Reporting and Reviewing officers

No. of Institutes Registered with HYPM (Password Issued to PME Cell I/Cs)	Scientist Registered with HYPM	Scientist Submitted Target	Reporting Officer Commented	Reviewing Officer Reviewed
97	4487	4127	4040	3938



Modules on Market Intelligence, Crop Economics and Post Harvest Management and Statistical Information have been developed. Market Intelligence module provides price of seed spices in various Mandis. Post Harvest Management module provides information on Storage, Grading and Quality specifications. Crop Economics provides information on production economics of all seed spice crops, cost benefit ratio and suggests the most suitable crop. The statistical information provides information on area, production, yield and export potential of seed spices.

Web Enabled Statistical Package for Factorial Experiments (SPFE 2.0)

The SPFE 2.0, which is a web enabled version of SPFE 1.0 developed earlier at IASRI, gives the designs for symmetrical and asymmetrical factorial experiments and



also performs analysis of the data generated. It generates randomized layout of the designs for factorial experiments with or without confounding. The software requires user input as a list of independent interactions to be confounded.

Different interaction(s) can be assigned for confounding in different replications. It also generates regular fractional factorial plans for symmetrical factorial experiments. The data are analyzed as per procedure of blocked/unblocked designs for single factor experiments. The treatment sum of squares can be partitioned into sum of squares due to main effects and interactions. A null hypothesis on any contrast of interest can also be tested. The package is also useful for illustration purposes in the classroom teaching as well as for the researchers in Statistics with interest in experimental designs particularly in factorial experiments. The package has been developed using C# and ASP.NET using the .NET technology.

The main features of the package are (i) Generation of selected design, (ii) Randomized layout of the design, (iii) Analysis of the data and (iv) Probability calculation.

(i) **Generation of the Designs**

This module generates designs for the following four situations viz., (i) Complete factorial without confounding (ii) Complete factorial with confounding (iii) Fractional factorial plans, and (iv) Balanced confounded designs.

(ii) **Randomization**

SPFE has a built-in facility to generate randomized layout of designs for all the options. This randomization includes randomization of the Replications, Blocks within Replications and Treatment combinations within each block. The randomization is achieved by using some standard library functions of C#. These functions generate uniform random variates by taking seed as time of the system clock.

(iii) **Analysis of Data Generated**

The option analysis in the Menu-Bar consists of the following submenus, which are displayed as follows:

- Single Factor
- Multiple Factor
- Main Effects and Interactions
- Single Degrees of Freedom Contrasts
- User Defined Contrast

(iv) **Probability Generation**

It generates the probability using the following distribution

- t-distribution
- Chi-square Distribution
- F-Distribution

SPFE Help

This feature includes the SPFE web help with index, content and search facility i.e. Individual Help and Complete Help of each Module of SPFE 2.0. It gives detail theory about each module, how to use each module from SPFE 2.0.

Management system for post graduate education-II

The aim is to strengthen the software “Management System for Post Graduate Education” for management of day to day activities of the University. The software is based on Web technologies and is accessible from the desktops of the students, faculty members and administrative officials in different disciplines under the P.G. School, IARI. Following activities were undertaken for incorporating user feedback by enhancing existing functionalities of the implemented modules and provide support to the users:

- Search functionality was created in the administrator section to search for students, users, courses and thesis. The same will be provided to all the users.
- A functionality was created to remove the left-out faculties and to add a course qualifying exam and thesis evaluation (2 credits each) in PPW.
- A functionality was created and implemented to record every transaction made by the faculty in the administrator module.
- PG school calendar was linked for the year 2012-13 for all users.
- Provisional certificates have been generated for all the M.Sc. students enrolled in 2010.
- Module for Clerk, TOSC, AAO, In-charge AIM sub-modules for PPW, ORW and Result workflows have been implemented.
- Registration of old and newly admitted M.Sc. and Ph.D. students for all the three trimesters on the Management System P.G. School, IARI was done.
- Mark sheets have been prepared through the system for all M.Sc. students enrolled in 2010.

The following reports were developed:

- The report for result submitted by course leaders.
- Report of class schedules uploaded by faculty members for various courses at professor level and dean level.
- Report on Multilingual degree generation and printing.
- The student reports were enhanced by adding their photos.

Technology Assessed and Transferred

Expert System on Seed Spices

- Expert system on seed spices has been developed and implemented to advise farmers on variety selection, field preparation, fertilizer application, schedule of irrigation, plant protection from pests diseases/nematodes. The system was demonstrated in Krishi Vigyan Mela at IARI during 6-8 March 2013. A presentation of the system was made and farmers were apprised about the e-platform during a training programme organized for the farmers by NRCSS, Ajmer. A demonstration of e-platform and formal interaction was also made by the team of e-platform for Seed Spice Growers with the farmers from Jodhpur at the Krishi Vigyan Kendra, Ajmer on 31 October 2012.



Maize AGRIdaksh

- Maize AGRIdaksh is the first system developed using AGRIdaksh tool, which provides ICT based expert advice on maize crop and allows interaction with experts using internet. Farmers can login to the website and can query for different pests and diseases and for their control and prevention. They can also seek help for the varieties recommended for their region for different purposes. Demonstrated the system in Krishi Vigyan Mela during 6-8 March 2013 at IARI, New Delhi. Farmers and other visitors found the system to be very useful. The site was accessed from 16 countries by over 2200 users from April 2012 to March 2013. Mushroom AGRIdaksh is also developed and available online. AGRIdaksh has been enhanced by incorporating multilingual features.





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 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 continued to conduct the following degree courses in collaboration with the Post Graduate School, IARI, New Delhi which has the status of a Deemed University

- (i) Ph.D. (Agricultural Statistics)
- (ii) M.Sc. (Agricultural Statistics)
- (iii) M.Sc. (Computer Application)
- (iv) M.Sc. (Bioinformatics)

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

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

Courses	Number of Students	
	Admitted	Completed
Ph.D. (Agricultural Statistics)	10	03
M.Sc. (Agricultural Statistics)	07	09
M.Sc. (Computer Application)	06	05
M.Sc. (Bioinformatics)	04	-

The research work carried out by students who had completed their degrees during 2012-13 is summarized as follows:

Ph.D. (Agricultural Statistics)

i) Bishal Gurung

A Study of Some Parametric Nonlinear Time-series Models in Agriculture

Linear time-series model, like Autoregressive integrated moving average (ARIMA), and nonlinear time-series models, like Exponential autoregressive (EXPAR) and Self exciting threshold autoregressive (SETAR) are generally used for modelling and forecasting of cyclical time-series data. In linear time series models, coefficients are fixed and therefore, may not be able to capture non-linearity in cyclical time-series data. Methodologies for combining these by using the constant coefficient regression method as well as the time-varying coefficient regression method through Kalman filter (KF) technique are developed and illustrated to describe annual Mackerel catch time-series data of Karnataka. It is shown that the latter method has performed better than the former one for the data under consideration.

The methodology for efficiently estimating the parameters of EXPAR model using Extended Kalman filter, which addresses the nonlinearity problem by linearizing the original nonlinear filter dynamics around the previous state estimates, is developed. For selected model, optimal out-of-sample forecasts for selected EXPAR model have been analytically derived by recursive use of conditional expectation. As an illustration, the methodology is successfully demonstrated for modelling and forecasting Oil sardine time-series landings data of Kerala.

As volatility seems to be the norm rather than an exception for agricultural commodities, an important parametric nonlinear time-series model called the Stochastic volatility (SV) model is studied to describe time-varying volatility. Lagrange multiplier test for testing presence of ARCH effects is also discussed. Estimation procedure for fitting of SV models to volatile data is developed by maximizing the Quasi-maximum likelihood using Kalman filter. Finally, the procedure for estimation of parameters of SV using sophisticated technique of Particle Filter (PF), a powerful Monte-Carlo technique, is also studied and illustrated on real data.

Guide: Dr. Prajneshu

ii) Sukanta Dash

Statistical Designs for Microarray Experiments

Microarray experiments are conducted to study the expression levels of thousands of genes simultaneously. In these experiments, the treatments are different types of tissues, drug treatments or time points of a biological process, which may be unstructured or have a factorial structure. For single factor microarray experiments, a general method of construction of efficient row-column designs for any number of treatments (v), number of columns satisfying the inequality $v \leq b \leq v(v-1)/2$ with two rows has been developed. A software module has been developed for online generation of most efficient row-column designs in the parametric range $3 \leq v \leq 10$, $v \leq b \leq (v-1)/2$, $11 \leq v \leq 35$, $b=v$ and $(v, b) = (11,12), (11,13), (12,13), (12,14), (13,14), (13,15), (13,16)$, along with their efficiencies. These designs have been made available at www.iasri.res.in/drs. In designs for multi-factor experiments, a method of construction of row-column designs in minimum number of replications for estimation of main effects and two factor interactions for 2^n factorial experiments has been developed. A catalogue of designs for $2 \leq n \leq 9$ has been prepared along with list of main effects and two factor interactions confounded in different replications. A procedure of

construction of row-column designs for estimation of all factorial effects with odd number of factors has also been given. For multi-factor microarray experiments, a procedure of obtaining efficient block designs for 3-factor mixed level factorial microarray experiments based on baseline parameterization has been given. A software module has been developed using C# programming language with ASP.NET platform for generation of efficient block designs for mixed factorial experiments in number of arrays equal to one less than the number of treatment combinations.

Guide: Dr. Rajender Parsad

iii) Kaustav Aditya

Some Contributions to Finite Population Mean Estimation in the Presence of Nonresponse

Sample surveys are generally planned to obtain reliable estimates of parameters of population as well as different sub-groups of the population called as domains. The presence of non-response in the survey not only introduces an element of bias in the survey results but the estimators also become less precise. Most of the work in survey sampling in the presence of nonresponse is dedicated to single stage and two phase sampling designs whereas in large scale surveys a multi-stage sampling design is commonly used. In view of the above, the problem of estimation of population parameter (population mean) as well as domain parameters (mean/total) in the presence of nonresponse when the sampling design under consideration is two-stage random sampling has been investigated. Accordingly, estimators were developed along with their variances and in some cases unbiased variance estimators for population/domain parameters. Both deterministic and random response mechanisms were considered. Through empirical study, it was found that all the three estimators were efficient for estimation of population and domain parameters over an estimator in which extra cost was incurred to obtain full response.

Guide: Dr. UC Sud

M.Sc. (Agricultural Statistics)

i) Sumit Chowdhury

A Study of Fuzzy Time-series Models in Agriculture

Fuzzy time series analysis is useful when the values of the response variable are not 'crisp' or 'precise' and are fuzzy. Forecasting of out-of-sample data using fuzzy time-series models is a challenging task. Methodology for fuzzy time-series modelling using non-convex membership functions has been developed. The

methodology developed removes the difficulty for out-of-sample forecast by difference operator based methodology by obtaining fuzzy forecast of future time point in intermediate step. Relevant computer programs required to compute the forecast values are developed in MATLAB. The methodology has been shown to be better than other existing methodologies for time-series modelling and forecasting with respect to mean square error, mean absolute error, and mean absolute prediction error.

Guide: Dr. Himadri Ghosh

ii) Pratyush Dasgupta

Robustness of Block Designs in Multi-response Experiments against Missing Data

Experiments in which data on several responses are measured from an experimental unit corresponding to the application of a treatment are known as multi-response experiments. Due to some unforeseen causes, some observations may become unavailable. It is well known that missing observations may lead to some serious loss to the original design. The property of an original design may change due to presence of missing observations. A connected design may become disconnected and even its efficiency may be small as compared to the original design. A design which can absorb such shocks is termed as robust design. Robustness of a design can be examined by two ways, through connectedness criterion and/or efficiency criterion. The robustness of block designs in multi-response experiments as per connectedness criterion as well as efficiency criterion against missing data has been studied. General expressions for studying robustness as per both the criteria are obtained for the loss of any t observations. These are then applied to Balanced Incomplete Block Designs by considering two cases. In the first case, when all the observations are lost from a plot is considered. Loss of any two plots has been considered in the second case. The designs that are robust as per connectedness criterion have been catalogued. The efficiencies of the connected designs are also worked out and provided in tables.

Guide: Dr. LM Bhar

iii) Chiranjit Mazumder

Application of Fuzzy C-Means Clustering Algorithm in Agriculture

Cluster analysis is one of the unsupervised pattern recognition techniques that can be used to organize data into groups based on similarities among the individual data

items. A non-linear principal component based fuzzy c-means clustering algorithms has been proposed in classifying 518 lentil genotypes based on their numeric agronomic and morphological traits. The principal component analysis was used for dimensionality reduction or feature extraction which also avoided the ill-effects of collinear variables. Results of the study revealed that genetic divergence is not highly related to geographical origins as exotic and indigenous lentil genotypes were distributed in all the four clusters. Further, the set of descriptors for the germplasm accessions consists of both numerical and categorical descriptors. This poses a problem for standard principal component analysis which deals with only numeric variables. Hence, nonlinear principal component analysis was used to analyze the descriptors of lentil accessions which can handle mixture of measurement types. The accessions plot based on nonlinear component showed that most of the indigenous genotypes/land races overlapped indicating their narrow genetic base. Most of the outlying accessions belonged to exotic origin or breeding lines derived from crosses with exotic lines. An effort was also made to use first two nonlinear principal components as input to fuzzy c-means algorithm in classifying lentil germplasm collections. The optimum number of clusters was obtained using validity measures. The study showed that principal component based fuzzy clustering has a promising potential in agriculture as a tool to evaluate, understand, predict and manage crop production.

Guide: Dr. GK Jha

iv) Anindita Datta

Row-Column Designs with Multiple Units per Cell

Row-column designs with multiple units per cell are useful for two-way elimination of heterogeneity settings, having more than one experimental units in each row-column intersection and are common in organoleptic evaluation studies, residual effect experiments, sugar beet trials, food industry etc. Most of the work on row-column designs with multiple units per cell is on designs with complete rows, complete columns and equal cell sizes. Some methods of constructing row-column designs with multiple units per cell have been developed that are structurally complete, i.e. all the cells corresponding to the intersection of row and column receive treatments. Some series of structurally complete row-column designs with multiple units per cell with unequal cell sizes and unequal replications of treatments have also been developed. In all these methods, either rows or columns are incomplete. All the methods

developed result in designs in which the elementary contrasts of treatment effects are estimated with same variance. Further, sometimes there may be situations when some units may not be available for experimentation or some of the treatments may be scarce. In such situations, it may not be possible for the experimenter to have the treatments in one or more cells of the row-column intersections i.e. there may be empty cells. Some methods of constructing structurally incomplete row-column designs with multiple units per cell with equal/ unequal cell sizes and equal/ unequal replications have been developed. These designs are found to be quite efficient as compared to an orthogonal design.

Guide: Dr. Seema Jaggi

v) Prakash Kumar

Block Designs with Nested Rows and Columns for Factorial Experiments

Sometimes experiments have to be conducted to study the effect of two or more factors simultaneously and the heterogeneity in the experimental material is in two directions then the appropriate design is factorial row-column (RC) design. In these designs some of the treatment effects are confounded in rows and some treatment effects are confounded in columns. These effects cannot be estimated if the experiment is conducted in a single row-column design. For estimating the effects that are confounded in a single row-column design, more number of row-column designs are required. Thus, there is a need to construct block design with nested row-column setup for factorial experiments so that the effects that are confounded in one row-column design can be estimated from other row-column designs. Designs for symmetric factorial experiments under nested row-column setting and for asymmetric factorial experiments under row-column settings have been constructed. For the construction these designs three methods (i) general confounding / equation method (ii) use of lattice squares designs (iii) use of extended group divisible designs, have been used. The block designs with nested row-column symmetric factorial experiments are balanced for treatment effects confounded. The effects that have been confounded for each of the row-column designs have been listed out. The efficiency factor the confounded effects has also been worked out. SAS code for C-matrix (information matrix) has been developed using PROC IML to check the estimability of the treatment effects.

Guide: Dr. Krishan Lal

vi) Manju Mary Paul

Functional Classification of Cereal Proteins using Support Vector Machine

Abiotic stress factors severely limit plant growth and development as well as crop yield. Various proteins of the plants are responsible for regulation of these abiotic stresses. Predicting the function of an unknown protein is an essential goal in bioinformatics. A highly accurate prediction method capable of identifying protein function, based on physicochemical properties of protein has been described. On the basis of 34 features extracted solely from the protein sequence, which are responsible for the regulation of different abiotic stresses *ie* heat, cold, drought and ABA, models were built to predict the functions of different proteins of Poaceae family. In this study, classification of cereal proteins has also been done using the secondary structure values such as Alpha-helix, β sheet, coil, and turn. Models for classification of cereal proteins have been developed using Support Vector Machine (SVM). Feature selection was performed by stepwise Logistic Regression by taking presence of abiotic stress as the response variable. This method analyses and identifies specific features of the protein sequence that are highly correlated with certain protein functions of these abiotic stresses. SVM was trained using different kernel functions such as radial, polynomial and sigmoid. Different measures such as sensitivity, specificity and accuracy has been calculated. Prediction error was also estimated using 10 fold and bootstrap cross validation technique. The accuracy of protein function prediction using SVM with different kernel functions ranged from 60% to 100% when classification was performed using physicochemical properties. Prediction accuracy of different models developed using structural composition with different kernel functions was also validated using bootstrap and 10 fold cross validation. Accuracy of prediction of these models ranges from 77% to 100% when classification was done based on structural composition.

Guide: Dr. Anil Rai

vii) Vandita Kumari

Crop Yield Forecast Model Using Ordinal Logistic Regression

The use of ordinal logistic model has been explored for forecasting wheat yield in Kanpur district of Uttar Pradesh. Weekly weather data (1971-72 to 2009-10) on five weather variables namely maximum

temperature, minimum temperature, morning relative humidity, evening relative humidity and rainfall for 16 weeks of the crop cultivation which include 40th standard meteorological week (SMW) to 52nd SMW of a year and 1st SMW to 3rd SMW of next year have been used in the study. Data from 1971-72 to 2006-07 have been utilized for model fitting and subsequent three years (2007-08 to 2009-10) were used for the validation of the model. Crop years were divided into two or three groups based on the detrended yield. Crop yield forecast models have been developed using probabilities obtained through ordinal logistic regression along with year as regressors for different weeks starting from 52nd SMW. Suitable strategy has been used to solve the problem of number of variables more than number of data points. This approach has been compared with that of discriminant function analysis. In discriminant function approach two types of models were developed, one using scores and another using posterior probabilities. Performance of the models obtained at different weeks was compared using Adjusted R², PRESS (Predicted error sum of square) and forecasts were compared using RMSE (Root mean square error) of forecast and MAPE (Mean absolute percentage error) of forecast. Using these criteria the model which came out to be most suitable for forecasting was based on ordinal logistic regression using two groups. Appropriate time of forecast was found to be 52nd standard meteorological week (11 weeks after sowing).

Guide: Dr. Ranjana Agrawal

viii) Ranganath HK

A Study of Linear Regression Models for Interval-valued Data

Classical statistical methodologies are not capable of analyzing data in intervals, which occur in many real situations. Therefore, methodology for analysis of data in intervals is considered. Specifically, computation of descriptive statistics, such as empirical frequency function, sample mean, sample variance, univariate and bivariate histograms for interval-valued data are discussed. Four different methods of fitting linear regression models for interval-valued data, viz. Centre method, Centre and range method, Constrained centre and range method, and Least absolute shrinkage and selection operator (LASSO) technique are described. Relevant computer programs are developed in SAS/IML and MATLAB software packages for fitting of the model. A comparative study of various methods is carried out on weekly meteorological data in intervals pertaining to Temperature and Relative humidity as

explanatory variables and Pan evaporation as response variable. It is concluded that for fitting linear regression models for interval-valued data, LASSO technique has performed the best for the data under consideration.

Guide: Dr. Prajneshu

ix) Raju Kumar

An Application of Calibration Approach for Estimation of Population Ratio

The calibration approach is frequently used to develop precise estimators of important population parameters like finite population ratio depending upon the extent of availability of auxiliary information. A calibration estimator uses calibrated weights, which are as close as possible, according to a given distance measure, to the original sampling design weights while also respecting a set of constraints, the calibration equations. The literature on estimation of complex parameters like population ratio, population variance/covariance etc. is very limited. Further, the chi-square type distance is generally used for determination of revised/calibrated weights. A higher level calibration approach has also been proposed for improving the variance estimator. If the calibrated weights take negative values, the use of negative weights in the variance estimator expression will provide negative variance estimator. In view of these problems, the proposed research has been taken with the specific objectives of non-negative calibrated weight using quadratic programming technique for variance estimation. For this purpose, the data given in Horvitz-Thompson (1952) has been taken for application of quadratic programming approach. From a population of 20 units, all possible equal probability without replacement samples of size 5 were drawn and calibrated weights were determined using the chi-square type distance function. In about 4.48 percent cases, negative weights were obtained. The quadratic programming approach was used for determining calibrated weights. For the application of quadratic approach, a program using proc optmodel procedure was written in SAS. The weights were recomputed using the quadratic programming approach. All the weights obtained through the quadratic programming approach were found to be non-negative.

The calibration approach was used to estimate the parameter of finite population ratio. Different calibrated weights were obtained for different situations of available auxiliary information as well as for different system of weights. The two situations of auxiliary information considered were 1) The population totals of auxiliary variables pertaining to numerator and denominator is

available separately and 2) Only the ratio of the population totals of auxiliary variable is available. The expression for variance and estimated variance of the estimators were developed. The performance of different calibrated weights was studied through a simulation study. The study revealed that the calibrated estimators perform better than an estimator of population ratio which does not make use of auxiliary information. Further, the calibrated estimator based on two systems of weights was found to perform better than the other calibrated estimators based on single weights in majority of cases.

Guide: Sh. SD Wahi

M.Sc. (Computer Application)

i) Inderjeet Singh Walia

Software for the Online Analysis of Row-Column Design

Experimentation is an integral part of any research endeavour. Designing an experiment is therefore very important so as to draw valid inferences from the data generated from the experiment keeping in view the objectives of the study and hypothesis to be tested. Block designs are used when the heterogeneity present in the experimental material is in one-direction. However, when the heterogeneity present in the experimental material is in two directions i.e. rows and columns, then double grouping is done which eliminates from the errors all differences among rows and equally all differences among columns. Designs used for the above situations are termed as Row-Column Designs (RCD) or designs for two-way elimination of heterogeneity. Due to their wide use in agricultural experimentation, a web based software for analysis of the data generated for RCD has been developed. It has been developed on .Net framework using C#. A statistical engine has been developed in the form of an object oriented C# library for analysis as per the statistical methodology. It also provides the analysis of several character simultaneously. The software has five modules namely ANALYSIS, SAMPLE DATA, CONTACT US, FEEDBACK and HELP accessible to the user through the Home page. Data input is from an Excel file on client side which is analyzed to give the analysis for RCD, p-values, R-square, coefficient of variation, root mean square error and mean of character. It also provides a framework which is easy to use, extend and integrate with other .Net compatible software tools.

Guide: Dr. PK Malhotra

ii) Sahi Ram

Expert System for Rapeseed-Mustard Crop

Rapeseed-mustard crop is grown in India in diverse agro climatic conditions. Most of the farmers do not know which variety is appropriate for a particular season and also for a particular area. They generally use the same variety over a long period of time. Besides this, pests and diseases are the major causes for the damages in the crops and result in economic loss to the farmers. Use of over dosages of pesticides and fungicides by farmers to save their crop also causes environmental hazards. This Ontologies based Expert System for Rapeseed-Mustard is designed to disseminate need based research findings to the farmers at a time so that they can take appropriate decisions. In conventional architecture of expert system, knowledge engineers along with domain experts build the knowledgebase manually and these expert systems are known to be working within a narrow domain of knowledge. But for building the expert system in agriculture for a vast and diverse country like India, the conventional approaches fail to meet the need of the farmers. Ontology is the latest knowledge representation technique that allows the domain experts to code their knowledge in a specific domain. It has the potential to be used in a distributed environment like Internet and provide dynamic and reusable capability to the knowledgebase. The system currently has been developed with robust JAVA technology and uses MS SQL Server as database. The system currently consists of knowledgebase of 10 diseases, 8 insects and 110 varieties of rapeseed-mustard. 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

iii) Rakesh Kumar Ranjan

Development of Software for Back Propagation Neural Network with Weight Decay Algorithm

The rapid advancements in the internet technology front have expanded the potentiality for web based software packages which allow quick and convenient sharing of methodology among researchers. Artificial Neural Networks (ANNs) are non-linear structures used for prediction and classification problems. ANNs can identify

and learn correlated patterns between input data sets and corresponding target values. Trained ANN can be used to predict the outcomes of independent variables. Over fitting and under fitting are two major problems that may arise in ANNs. Multi-collinearity is a statistical phenomenon in which two or more predictor variables in a model are highly correlated and provide redundant information about the response. The problem of multi-collinearity leads to overtraining. This problem is handled by using ANNs with weight decay algorithm. Most of the software available for analyzing the data using ANN are either very costly or difficult to use. In this study, a web based software for back propagation neural networks with weight decay algorithm has been developed. Waterfall model has been used for software development process. This software is useful for statistician and researchers working in the area of agriculture.

Guide: Ms. Anu Sharma

iv) Sreekumar Biswas

Building and Querying Ontology for Agriculturally Important Microbes

Traditional knowledge representation techniques generate unstructured knowledge. The need of converting the unstructured knowledge into structured knowledge is highly felt. Ontologies are the new form of knowledge representation technique that acts in synergy with agents and Semantic Web architecture. Building ontologies in different domains of agriculture are helpful to convert unstructured knowledge into structured knowledge, which can be shared across different applications. The microorganisms represent a crucial role in the world of agriculture. In this work, an attempt has been made to develop a web based software for the microorganisms, important from agricultural point of view. There are many classification systems for microbes, but the Three Domain System of Microbial Taxonomy is most accepted worldwide. Microbial ontology has been designed and created for Three Domain System of Microbial Taxonomy through Protégé 3.4.6 OWL editor from Domain to Genus level for those bacteria which are important in agriculture. Using this microbial ontology, a web based application, Microbial Taxonomy Ontology has been developed. This application has N-tier architecture, application development environment as NetBeans IDE 7.0.1, Protégé 3.4.6, Web development technology as Java Server Pages (JSP) and SPARQL. Semantic Web Framework layer is implemented using JENA. The

search facility provides Three Domain System of microbial taxonomy for agriculturally important bacteria in details up to Genus level of the twenty domains. Domain experts can see and edit the knowledge base (i.e. Microbial Ontology) or can suggest anything related to the creation of Microbial Taxonomy Ontology through a user friendly web interface. By using Advance Search navigation key, one can easily classify an unknown microbe up to Genus level. This software also facilitates name based search for all microbial taxonomic terms. Other applications can use its knowledgebase as it is in the form of Ontology.

Guide: Dr. Sudeep

v) Chandan Kumar Deb

Building Soil Ontology up to Soil Series

Web based software which use ontology as their knowledge base are gaining importance as they act in synergy with agents and Semantic Web Architecture. Ontologies define domain concepts and the relationships between them, and thus provide a domain language that is meaningful to both humans and machines. For the web, ontology is about the exact description of web information and relationships between web information. Taxonomies describe real world concepts in well-defined hierarchy and exist in standardized form for numerous domains of knowledge. It is imperative that ontologies are built in different domains of agriculture that help to convert unstructured knowledge into structured one which can be shared across applications. Soil Ontology developed for USDA soil taxonomy by Das (2010) and Das *et al.* (2012) for Soil Orders available in India only up to Sub group level has been used to develop a web based application that now covers all the twelve orders worldwide. The developed soil ontology now is available up to Family and Series level. The developed web based application is having N-tier architecture, developed using NetBeans 6.9 editor, Protégé, Java Server Pages (JSP) and SPARQL. Semantic Web Framework layer is implemented using JENA. Information related to soil taxonomy and newly found soils can be easily classified according to USDA soil taxonomy by mentioning their properties. Domain experts can edit or add any new information about the soil taxonomy. By using Advance Search navigation key one can easily classify a newly found soil up to series level. This software also facilitates name based search for all soil taxonomic terms. By using the series navigation key, one can easily get the

detailed information of state wise series description. Other applications can use its knowledgebase as it is in the form of Ontology.

Guide: Dr. PK Malhotra

Research Fellowship

During 2012-13, 15 Ph.D. and 33 M.Sc. students received research fellowship. 15 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. 12 M.Sc. students received ICAR Junior Research Fellowship at the rate of Rs. 8640/- p.m. besides Rs. 6000/- per annum as the contingent grant and 21 M.Sc. students received IASRI fellowship at the rate of Rs. 7560/- p.m. besides Rs. 6000/- per annum as the contingent grant.

Strengthening of Post Graduate Programme

On the basis of funds received from P.G. School, IARI, the teaching program in the discipline of Agricultural Statistics, Computer Application and Bioinformatics have been strengthened with modernization of class-rooms, upgrading of computers /servers/software and related equipments for the students and faculty keeping in pace with developments.

P.G. School Management System

PG School, IARI Management System is developed under the IASRI Institute funded project “Intranet Solutions for PG School, IARI” by Division of Computer Applications, IASRI. The system helps in achieving the PG School objectives by giving online access to various resources. 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

CERTIFICATE COURSE

Senior Certificate Course in Agricultural Statistics and Computing: 5 participants

The Institute continued to conduct Senior Certificate Course in Agricultural Statistics and Computing for the benefit of research workers engaged in handling statistical data collection, processing, interpretation and employed in research Institutes of the Council, State Agricultural Universities and State Government Departments, etc. and foreign countries including SAARC countries. The main aim is to train the participants in the use of latest statistical techniques as well as use of computers and software packages. The course comprise of two independent modules of three months duration each.

The course was organized during the period 18 June 2012 to 24 November 2012 (Module-I: 18 June - 18 August 2012 and Module-II: 03 September - 24 November 2012). The main topics covered under the course included Statistical Methods, Official Agricultural Statistics, Use of Computers in Agricultural Research, Sampling Techniques, Econometrics, Forecasting Techniques, Design of Experiments and Statistical Genetics.

NATIONAL /INTERNATIONAL TRAINING PROGRAMMES

Summary of Training Programmes Organised

Category	Training Programmes	No. of Participants
International	02	13
National	19	361
CAFT	04	86
Summer / Winter School	02	50
NAIP	06	103
Resource Generation	04	70
Others	03	52
Total	21	374

Details of Training Programmes Organised					
S.No.	Title	Venue	Duration	Sponsored by	No. of Participants
International (2: 13 Participants)					
1.	Techniques of Estimation and Forecasting of Crop Production in India Course Director: UC Sud Course Co-Director: Hukum Chandra	IASRI, New Delhi	23 May to 02 June 2012	Food & Agriculture Organization (FAO)	07
2.	Applications of Remote Sensing and GIS in Agricultural Surveys Course Director: Prachi Misra Sahoo Course Co-Director: Tauqueer Ahmad	IASRI, New Delhi	24 January to 13 February 2013	Afro-Asian Rural Development Organization (AARDO)	06
National (19: 361 Participants)					
Centre of Advanced Faculty Training (4: 86 Participants)					
3.	Statistical Models for Forecasting in Agriculture Course Director: Ramasubramanian V. Course Co-Director: Mir Asif Iquebal	IASRI, New Delhi	11 September to 01 October 2012	Education Division, ICAR	25
4.	Recent Advances in Sample Survey and Analysis of Survey Data using Statistical Software Course Director: Hukum Chandra Course Co-Director: Kaustav Aditya	IASRI, New Delhi	03-23 October 2012	Education Division, ICAR	18
5.	Recent Advances in Designing and Analysis of Agricultural Experiments Course Director: Krishan Lal Course Co-Directors: Anil Kumar Eldho Varghese	IASRI, New Delhi	08-28 January 2013	Education Division, ICAR	22
6.	Development of Expert System through AGRIdaksh Course Director: Sudeep Course Co-Directors: Alka Arora Pal Singh	IASRI, New Delhi	14 February to 06 March 2013	Education Division, ICAR	21
Summer/Winter School (2: 50 Participants)					
7.	Summer School on Forecast Modelling in Crops Course Director: KN Singh Course Co-Directors: N. Okendro Singh DR Singh	IASRI, New Delhi	17 July to 06 August 2012	Education Division, ICAR	25
8.	Winter School on Recent Advances on Quantitative Genetics and Statistical Genomics Course Director: AR Rao	IASRI, New Delhi	06-26 November 2012	Education Division, ICAR	25
National Agricultural Innovation Project (6: 103 Participants)					
9.	Dissemination cum Training Workshop on Technology Forecasting Methods with Application in Agriculture	IASRI, New Delhi	06-15 June 2012	V-Page sub program II: Technology Forecasting & Policy Analysis	11

10.	Forecast Modelling in Crops Using Weather and Geo-informatics Course Director: KN Singh Course Co-Directors: Anshu Bhardwaj Amrender Kumar	IASRI, New Delhi	22 August to 04 September 2012	NAIP	15
11.	Sensitization programme under the project Strengthening Statistical Computing for NARS Course Co-ordinators: Samir Farooqi Dwijesh Mishra	NBAIM, Mau	22-24 November 2012	NAIP	14
12.	Statistical Approaches for Genomic Data Analysis Course Director: Seema Jaggi Course Co-Director: Sarika	IASRI, New Delhi	07-19 January 2013	NAIP	19
13.	Data Analysis using SAS Course Director: Rajender Parsad Course Co-ordinators: Seema Jaggi VB Singh (RVSKVV, Gwalior)	RVSKVV, Gwalior	18-23 February 2013	NAIP	21
14.	Data Analysis using SAS Course Director: Ramasubramanian V. Course Co-ordinators: Samir Farooqi Rajesh Sharma and Vipin Ladha (SKRAU, Bikaner)	SKRAU, Bikaner	04-09 March 2013	NAIP	23
Resource Generation (5: 78 Participants)					
15.	Data Analysis and Interpretation: Use of Statistical Software Course Director: Rajender Parsad Course Co-Directors: Krishan Lal Susheel Kumar Sarkar	IASRI, New Delhi	14 May to 01 June 2012	Central Statistical Organization Ministry of Statistics & Programme Implementation	38
16.	Agricultural Statistics Course Director: KK Tyagi Course Co-Director: Tauqueer Ahmad	IASRI, New Delhi	30 October to 02 November 2012	Department of Agriculture, Govt. of Andhra Pradesh	15
17.	Small Area Estimation Course Director: UC Sud Course Co-Director: Hukum Chandra	IASRI, New Delhi	03-08 December 2012	Central Statistical Organization Ministry of Statistics & Programme Implementation	11
18.	Study tour on Agricultural Statistics System and Food Security Policy Analysis in India for DPR Korea Course Director: UC Sud Course Co-ordinator: Tauqueer Ahmad	IASRI, New Delhi	04-08 February 2013	Food and Agriculture Organization (FAO)	06
Others (3: 52 Participants)					
19.	Functions and Activities of IASRI Organizer: Seema Jaggi	IASRI, New Delhi	07 December 2012	National Academy of Statistical Administration (NASA)	08
20.	Elementary Data Analysis for Technical Personnel of ICAR Course Director: Cini Varghese Course Co-Director: Susheel Sarkar	IASRI, New Delhi	11-15 March 2013	ICAR	20
21.	Website Development and Hosting for Technical Personnel of ICAR Course Director: Pal Singh Course Co-Director: Sudeep	IASRI, New Delhi	18-22 March 2013	ICAR	24

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

S. No.	Name	Year of induction
1.	Dr. UC Sud, Director (A) (w.e.f. 01.03.2013) & Head (SS)	1995
2.	Dr. VK Bhatia, Director (superannuated on 28.02.2013)	1987
3.	Dr. VK Gupta, National Professor	1984
4.	Dr. Prajneshu, Principal Scientist and Head (Statistical Genetics)	1984
5.	Dr. Rajender Parsad, Principal Scientist, Head (Design of Experiments) & Professor (Agricultural Statistics)	1995
6.	Dr. Anil Rai, Principal Scientist & Head (Centre for Agricultural Bioinformatics)	1995
7.	Dr. KN Singh, Principal Scientist & Head (Forecasting & Agricultural System Modeling)	2011
8.	Dr. Ranjana Agrawal, Principal Scientist	1988
9.	Sh. SD Wahli, Principal Scientist	1987
10.	Dr. KK Tyagi, Principal Scientist	1995
11.	Dr. Krishan Lal, Principal Scientist	2003
12.	Dr. RL Sapra, Principal Scientist (at IARI)	2002
13.	Dr. Seema Jaggi, Principal Scientist	1995
14.	Dr. Lal Mohan Bhar, Principal Scientist	1998
15.	Dr. Amrit Kumar Paul, Senior Scientist	1998
16.	Dr. Tauqueer Ahmad, Senior Scientist	1998
17.	Dr. AR Rao, Senior Scientist	1998
18.	Dr. Ramasubramanian V., Senior Scientist	1999
19.	Dr. Girish Kumar Jha, Senior Scientist (at IARI)	1999
20.	Dr. Cini Varghese, Senior Scientist	2000
21.	Dr. Himadri Ghosh, Senior Scientist	2004
22.	Dr. Prachi Misra Sahoo, Senior Scientist	2002
23.	Dr. Hukum Chandra, Senior Scientist	2003
24.	Dr. Amrender Kumar, Scientist	2003
25.	Md. Wasi Alam, Scientist	2003
26.	Dr. Prawin Arya, Senior Scientist	2003
27.	Dr. Anil Kumar, Senior Scientist	2010
28.	Dr. Sanjeev Panwar, Scientist	2011
29.	Dr. Ranjit Kumar Paul, Scientist	2011
30.	Dr. Mir Asif Iqbal, Scientist	2011
31.	Dr. BN Mandal, Scientist	2011
32.	Dr. Susheel Kumar Sarkar, Scientist	2011
33.	Dr. N Okendro Singh, Scientist (Relieved on 28.02.2013)	2011
34.	Dr. Eldho Varghese, Scientist	2011
35.	Dr. Kaustav Aditya, Scientist	2012

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

S. No.	Name	Year of induction
1.	Dr. PK Malhotra, Principal Scientist & Professor (Computer Application)	1991
2.	Dr. RC Goyal, Principal Scientist	1995
3.	Dr. Sudeep, Senior Scientist	2002
4.	Dr. Alka Arora, Senior Scientist	2001
5.	Ms. Anu Sharma, Scientist	2004
6.	Ms. Shashi Dahiya, Scientist	2001
7.	Md. Samir Farooqi, Scientist	2001
8.	Sh. KK Chaturvedi, Scientist (on study leave)	2002
9.	Sh. SN Islam, Scientist	2004
10.	Sh. SB Lal, Scientist	2004
11.	Ms. Anshu Bhardwaj, Scientist	2004
12.	Ms. 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 P.G. SCHOOL, IARI IN
BIOINFORMATICS**

S. No.	Name	Year of induction
1.	Dr. VK Bhatia, Director (superannuated on 28.02.2013)	2010
2.	Dr. Prajneshu, Principal Scientist, Head (Statistical Genetics) & Professor (Bioinformatics)	2010
3.	Dr. KC Bansal, Director, NBPGR	2010
4.	Dr. Rajender Parsad, Principal Scientist, Head (Design of Experiments)	2010
5.	Dr. Anil Rai, Principal Scientist & Head (CABIN)	2010
6.	Dr. Seema Jaggi, Principal Scientist	2010
7.	Dr. AR Rao, Senior Scientist	2010
8.	Dr. Sudeep, Senior Scientist	2010
9.	Sh. SB Lal, Scientist	2010
10.	Mohd. Samir Farooqi, Scientist	2010
11.	Ms. Anu Sharma, Scientist	2010
12.	Dr. TR Sharma, Principal Scientist (at NRCPB)	2010
13.	Dr. T Mahapatra, Principal Scientist (at NRCPB)	2010
14.	Dr. Kishore Gaikwad, Senior Scientist (at NRCPB)	2010
15.	Dr. RL Sapra, Principal Scientist (at IARI)	2010
16.	Dr. T Napoleon, Senior Scientist (at IARI)	2010
17.	Dr. PK Singh, Senior Scientist (at IARI)	2010
18.	Dr. PS Pandey, Principal Scientist (at IARI)	2010
19.	Dr. KV Bhat, Principal Scientist (at IARI)	2010
20.	Dr. SS Marla, Principal Scientist (at NBPGR)	2010
21.	Dr. Sunil Archak, Scientist (at NBPGR)	2010
22.	Dr. DC Mishra, Scientist	2010
23.	Dr. Sarika, Scientist	2010
24.	Sh. Sanjeev Kumar, Scientist	2010

COURSES TAUGHT DURING THE ACADEMIC YEAR 2011–12

Code	Title	Course Instructors
AGRICULTURAL STATISTICS		
Trimester – III		
PGS-504	Basic Statistical Methods in Agriculture (2+1)	Ramasubramanian, V & Susheel Kumar Sarkar
AS-503	Basic Sampling and Non-parametric Methods (2+1)	Hukum Chandra, UC Sud, Sanjeev Panwar & LM Bhar
AS-563	Statistical Inference (4+1)	Rajender Parsad, LM Bhar & GK Jha
AS-564	Design of Experiments (3+1)	Seema Jaggi, VK Gupta & BN Mandal
AS-566	Statistical Genetics (3+1)	VK Bhatia
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 & N Okendro Singh
AS-691	Seminar (1+0)	BN Mandal
COMPUTER APPLICATION		
Trimester – III		
CA 503	Statistical Computing in Agriculture (1+2)	Krishnal Lal, Amrit Kumar Paul & Rajender Parsad
CA 563	Operating System (2+1)	Soumen Pal
CA 567	Computer Networks (2+1)	SN Islam & Alka Arora
CA 571	Modeling and Simulation (2+1)	PK Malhotra & Anshu Bharadwaj
CA 691	Seminar (1+0)	Alka Arora
BIOINFORMATICS		
Trimester – III		
BI 510	Biological Databases and Data Analysis (2+1)	SB Lal, Sanjeev Kumar & Samir Farooqi
BI 511	RNA / Protein Structure Prediction & Molecular Modeling (1+2)	SS Marla & Sarika
BI 512/ AS 608	Advanced Bioinformatics (2+1)	AR Rao, M Grover & DC Mishra
BI 691	Seminar (1+0)	Sanjeev Kumar

COURSES TAUGHT DURING THE ACADEMIC YEAR 2012–13

Code	Title	Course Instructors
AGRICULTURAL STATISTICS		
Trimester – I		
PGS-504	Basic Statistical Methods in Agriculture (2+1)	KK Tyagi, AK Gupta & Anil Kumar
AS-501	Basic Statistical Methods (2+1)	Mir Asif Iquebal & Kaustav Aditya
AS-550	Mathematical Methods (4+0)	Cini Varghese & Himadri Ghosh
AS-560	Probability Theory (2+0)	KN Singh
AS-561	Statistical Methods (2+1)	Ranjit Kumar Paul & Eldho Varghese
AS-567	Applied Multivariate Analysis (2+1)	Ranjana Agrawal & AR Rao
AS-568	Econometrics (2+1)	GK Jha & Prawin Arya
AS-569	Planning of Surveys / Experiments (2+1)	UC Sud, KK Tyagi & Krishan Lal
AS-572	Statistical Quality Control (2+0)	Wasi Alam
AS-600	Advanced Design of Experiments (1+1)	Rajender Parsad & Cini Varghese
AS-601	Advanced Sampling Techniques (1+1)	Prachi Misra Sahoo & Hukum Chandra
AS-602	Advanced Statistical Genetics (1+1)	SD Wahi & AK Paul
AS-603	Regression Analysis (1+1)	LM Bhar & N Okendro Singh
AS-604	Linear Models (2+0)	Krishan Lal & VK Gupta
AS-606	Optimization Techniques (1+1)	UC Sud & Prajneshu
AS-691	Seminar (1+0)	BN Mandal
Trimester – II		
PGS-504	Basic Statistical Methods in Agriculture (2+1)	KK Tyagi, BN Mandal & 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 & Ramasubramanian V
AS-565	Sampling Techniques (3+1)	Tauqueer Ahmad, Prachi Misra Sahoo & Kaustav Aditya
AS-570	Statistical Modeling (2+1)	Prajneshu & Mir Asif Iquebal
AS-571	Bioinformatics (3+1)	TR Sharma, Sunil Archak, AR Rao & Rajender Parsad
AS-575	Demography (2+0)	Bishal Gurung & AK Gupta
AS-605	Advanced Statistical Inference (1+1)	KN Singh, Anil Rai & Ranjit Kumar Paul
AS-607	Stochastic Processes (3+0)	Himadri Ghosh & Sanjeev Kumar
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)	Bishal Gurung
COMPUTER APPLICATION		
Trimester – I		
CA-502/BI-502	Introduction to Computer Application (1+1)	Samir Farooqi & SN Islam
CA-551	Mathematical Foundations in Computer Application (4+0)	NK Sharma & DC Mishra
CA-552	Computer Oriented Numerical Methods (2+1)	Pal Singh & KP Singh
CA-560	Computer Organization and Architecture (3+1)	Shashi Dahiya & Yogesh Gautam
CA-561/BI-505	Principles of Computer Programming (2+1)	Anu Sharma & Sudeep
CA-565	Compiler Construction (2+1)	Sangeeta Ahuja & Soumen Pal
CA-569	Web Technologies & Applications (2+1)	Alka Arora & SB Lal
CA-575	Artificial Intelligence (2+1)	Sudeep & Rajni Jain
CA-691	Seminar (1+0)	Anshu Bhardwaj



Trimester – II		
CA-501	Computer Fundamentals and Programming (3+1)	Pal Singh & KP Singh
CA-562	Object Oriented Analysis and Design (2+1)	Sudeep & Sangeeta Ahuja
CA-564	Data Structures and Algorithms (2+1)	Shashi Dahiya & AP Ruhil
CA-566/BI-506	Database Management System (2+2)	OP Khanduri, Anu Sharma & SB Lal
CA-568	Software Engineering (2+0)	Rajni Jain & RC Goyal
CA-572	GIS & Remote Sensing Techniques (2+1)	Prachi Misra Sahoo & Anshu Bharadwaj
CA-573	Data Warehousing (2+1)	Anil Rai & Samir Farooqi
CA-577	Data Mining & Soft Computing (2+1)	Anshu Bharadwaj, Alka Arora & Rajni Jain
CA-691	Seminar (1+0)	Pal Singh
BIOINFORMATICS		
Trimester – I		
BI-501	Molecular Cell Biology (3+0)	Sarvjeet Kaur, Monika Dalal & Rekha Kansal
BI-502/CA-502	Introduction to Computer Application (1+1)	Samir Farooqi & SN Islam
BI-504	Principles of Biotechnology (3+0)	RC Bhattacharya, D Patanayak, Amole Kumar & U Solanki
BI-505/CA-561	Principles of Computer Programming (2+1)	Anu Sharma & Sudeep Marwah
BI-524	Tools and Techniques for Biological Data Mining (2+1)	Sanjeev Kumar & AK Mishra
BI-525	Advanced Programming in Bioinformatics (2+1)	SB Lal & Anu Sharma
BI-691	Seminar (1+0)	Sarika
Trimester – II		
BI-506	Database Management System (2+2)	OP Khanduri, Anu Sharma & SB Lal
BI-507	Bioinformatics (1+1)	TR Sharma, Sunil Archak, AR Rao & Rajender Parsad
BI-508	Protein Biosynthesis (3+0)	Archana Sachdev, IM Santha, Vnutha T & Veda Krishnan
BI-509	Genomics & Proteomics ()	NK Singh, TR Sharma, Kishor Gaikwad & Subodh Kumar Sinha
BI-691	Seminar (1+0)	Sudhir Srivastava

Note: Figures in the parentheses indicate the number of credits (Lectures + Practicals)

BOARD OF STUDIES FOR ACADEMIC YEAR 2012-13		
Agricultural Statistics		
1. Dr. Rajender Parsad, Professor (Agricultural Statistics)	Chairman	
2. Dr. VK Bhatia, Director	Ex-officio Member (superannuated on 28.02.2013)	
3. Dr. UC Sud, Director (A)	Ex-officio Member (w.e.f. 01.03.2013)	
4. Sh. SD Wah, Principal Scientist	Member	
5. Dr. Hukum Chandra, Senior Scientist	Member	
6. Dr. BN Mandal, Scientist	Member Secretary	
7. Sh. Rohan Kumar Raman	Student Representative	
Computer Application		
1. Dr. PK Malhotra, Professor (CA)	Chairman	
2. Dr. VK Bhatia, Director	Ex-officio Member (superannuated on 28.02.2013)	
3. Dr. UC Sud, Director (Acting)	Ex-officio Member (w.e.f. 01.03.2013)	
4. Dr. Rajini Jain, Senior Scientist	Member	
5. Dr. Alka Arora, Senior Scientist	Member	
6. Sh. SN Islam, Scientist	Member	
7. Ms. Anshu Bhardwaj, Scientist	Member Secretary	
8. Sh. Kamilka Nath	Student Representative	
Bioinformatics		
1. Dr. Prajneshu, Professor (Bioinformatics)	Chairman	
2. Dr. VK Bhatia, Director	Ex-officio Member (superannuated on 28.02.2013)	
3. Dr. UC Sud, Director (Acting)	Ex-officio Member (w.e.f. 01.03.2013)	
4. Dr. SS Malra, Principal Scientist	Member	

5. Dr. Kishore Gaikwad, Senior Scientist	Member
6. Dr. Anil Rai, Principal Scientist	Member
7. Dr. PK Singh, Senior Scientist	Member
8. Dr. AR Rao, Senior Scientist	Member
9. Dr. Sarika, Scientist	Member Secretary
10. Km. Priya Prabhakar	Student Representative

CENTRAL EXAMINATION COMMITTEE FOR ACADEMIC YEAR 2012-13

Agricultural Statistics

1. Dr. VK Bhatia, Director (superannuated on 28.02.2013)
2. Dr. VK Gupta, National Professor
3. Dr. Rajender Parsad, Head (DE) & Professor (Agricultural Statistics)
4. Dr. Prajneshu, Head (SG) & Professor (Bioinformatics)
5. Dr. UC Sud, Principal Scientist & Head (SS)
6. Dr. Himadri Ghosh, Senior Scientist

Computer Application

1. Dr. VK Bhatia, Director (superannuated on 28.02.2013)
2. Dr. PK Malhotra, Professor (CA)
3. Dr. RC Goyal, Principal Scientist
4. Dr. Seema Jaggi, Principal Scientist
5. Dr. Sudeep, Senior Scientist
6. Dr. Alka Arora, Senior Scientist
7. Dr. Rajini Jain, Senior Scientist (NCAP)
8. Ms. Shashi Dahiya, Scientist (Sr. Scale)

Bioinformatics

1. Dr. VK Bhatia, Director (superannuated on 28.02.2013)
2. Dr. Prajneshu, Head (SG) & Professor (Bioinformatics)
3. Dr. Anil Rai, Head (CABin)
4. Dr. AR Rao, Senior Scientist
5. Dr. T Napoleon, Senior Scientist
6. Dr. Sunil Archak, Senior Scientist



IMPLEMENTATION OF MIS & FMS IN ICAR



HOME ABOUT PROJECT FEED BACK CONTACT US HELP

Welcome

AN ERP solution for ICAR is being developed at IASRI under NAIP sub-project "Implementation of Management Information System (MIS) including Financial Management System (FMS) in ICAR". This system includes solutions for Financial Management, Project Management, Material Management, Human Resource Management & Payroll at ICAR.

- a) **Financial Management:** Solutions for General ledger, Account Payable, Account Receivable, Cash Management, Fixed Assets Management, Budget Management and grants.
- b) **Project Management:** Scope for Project Information, Costing, Project Documents, Contract Management and Collaboration of Project documents.
- c) **Material Management:** Solutions for 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 all the ICAR employees.

The implementation of ERP Solution would be for ICAR Head Quarter and its Institutes. Oracle R12 solution, which is a global enterprise system with high level of inbuilt security features, has been identified for implementation of this system. IBM India Ltd. company has been identified as system integrator for studying the requirement of ICAR institutions and customization of Oracle solutions as per ICAR needs and implementation of the same at all the ICAR institutions in two phases.

Slide Show

Asi's Session



Held on 30/04/2012



Announcements

14 September, 2012

Website for the NAIP funded project MIS/FMS has been developed and hosted at IASRI server at the address (<http://iasri.res.in/misfms/>). All necessary documents will be accessible from this site. You are requested to register yourself in the system so as you will have access to all those documents and relevant information. Please register and give your valuable



Half-Yearly Progress Monitoring System of Scientists



HOME RESOURCES CONTACT US PROPOSED ICAR EMAIL ID PROPOSED ENQUIRY ID

To implement Dr. P.L. Gantam's Committee recommendations on DG Half-Yearly Progress Monitoring (HYPM) of the Scientists in ICAR, a web based software has been designed and developed at IASRI, New Delhi with a view to ensure more objective evaluation of the half-yearly performance of Scientists in ICAR.

The HYPM is being maintained at the Central Server of IASRI, New Delhi and is accessible at <http://hypm.iasri.res.in/>. Authenticated access has been given to all concerned scientists, reporting officers, reviewing officers and research managers.

ASs (ICAR) scientist posted at any one of the ICAR institutes has access to HYPM software through a unique UserID & Password. Facility has been provided to enter proposed targets for the coming half-year and achievements of the completed half-year independently with respect to Research, Teaching, Training, Extension and Other Prioritized Activities.

The Reporting Officer (Head of Division/Regional Station) has access to the Proposed Targets & Achievements details submitted by all concerned scientists. He/She may add his/her remarks and give recommendations on the basis of the progress reports/inputs submitted by the concerned scientists.

Reviewing Officer has dual facilities as he/she may be the Reporting Officer and as well as Reviewing Officer for some scientists like Head of Divisions and Reviewing Officer for other scientists. The Reviewing Officer is able to add his/her own Assessment Remarks and Final Overall Grading on the Proposed Targets and Achievements of all scientists. Finally, Institute/SMD/ICAR Level Membership Reports are generated.

Date Extended - For submission of target and achievement in HYPM, date has been extended upto 20th April 2013 for Scientists and simultaneously upto 25th April 2013 for Reporting and Reviewing Officers.

Member's Login

User Name

Password

Submit

[Forgot Password](#)

Announcements

17th October, 2012

The last date for submission of targets

achievement has been extended upto 22nd

October 2012.

5

Awards and Recognitions

AWARDS

- Dr. VK Bhatia received Bharat Ratna Dr. C Subramaniam Award for Outstanding Teachers in Agriculture and Allied Sciences 2011 for excellent teaching in the field of Social Sciences on 16 July 2012 at the Foundation Day of the Indian Council of Agricultural Research.



Scientists of the Institute received following awards from Indian Society of Agricultural Statistics (ISAS) during its 66th Annual Conference organized as International Conference on Statistics and Informatics in Agricultural

Research at IASRI, New Delhi during 18-20 December 2012:

- **ISAS Fellows**
 - Dr. VK Gupta, ICAR National Professor
 - Dr. VK Bhatia, Director, IASRI
- **Sankhyiki Bhushan Award**
 - The prestigious title of Sankhyiki Bhushan was conferred on Dr. Prajneshu, Principal Scientist and Head, Division of Statistical Genetics, IASRI.



● **Prof. PV Sukhatme Gold Medal Award**

- Dr. Seema Jaggi, Principal Scientist received Prof. PV Sukhatme Gold Medal Award for the year 2012 for her significant contribution in Agricultural Statistics.



● **Dr. DN Lal Memorial Lecture Award**

- Dr. Hukum Chandra, Senior Scientist received Dr. DN Lal Memorial Award for the year 2012 for his significant contribution in Agricultural Statistics.



● **Dr. GR Seth Memorial Young Scientist Award**

- Dr. Ranjit Kumar Paul, Scientist received Dr. GR Seth Memorial Young Scientist Award for the year 2012.



● **Following papers published during 2010-11 in Journal of ISAS were awarded Best Paper**

– **Design of Experiments**

VK Gupta, AK Nigam, Rajender Parsad, LM Bhar and Subrat Keshori Behera (2011). Resolvable Block Designs for Factorial Experiments with Full Main Effect Efficiency. **65(3)**, 305-315.

– **Sample Surveys**

UC Sud, Hukum Chandra and Raj S Chhikara (2010). Domain Estimation in the Presence of non-Response. **64(3)**, 343-347.

– **Applied Statistics**

KN Singh, Abhishek Rathore, AK Tripathi, A Subba Rao and Salman Khan (2010). Soil Fertility Mapping and its Validation using Spatial Prediction Techniques. **64(3)**, 359-365.

- **Dr. Himadri Ghosh** received Bose-Nandi Award (jointly with Dr. Ramakrishna Singh and Dr. Prajneshu) for the best publication in the section “Applications of Statistics” of the Calcutta Statistical Association Bulletin for the year 2008.

- **Iquebal, MA, Sarika, Arora, Vasu, Verma, Nidhi, Rai, Anil and Kumar, Dinesh***. Whole genome based microsatellite DNA marker database of tomato: TomSatDB. Received Best Paper Award in National Conference on “NexGen Biotechnology: Amalgamating Science and Technology” at Kurukshetra University, during 23-24 November 2012.

● **Dr. Anil Kumar**

- Received Smt. Kadambini Devi Award-2013 on research paper “Vocal tract resonances as indexical cues in Karan Fries cows” by The Indian Society of Animal Production and Management in the National Seminar & XX Annual Convention held at NDRI, Karnal during 28-30 January 2013.
- Received Best Poster Presentation Award for research paper entitled “Influence of Zinc-biotin supplementation on lameness in KF cows during periparturient period” authored by Pragya Bhadauria, SS Lathwal, YS Jadoun, Shiv Prasad and Anil Kumar by The Indian Society of Animal Production and Management in the National Seminar & XX Annual Convention held at NDRI, Karnal during 28-30 January, 2013.

- **Dr. BN Mandal** selected for Indo-Australia Early Career S & T Visiting Fellowship 2012-13.



RECOGNITIONS

Dr. VK Bhatia

- Nominated as Statistical Coordinator for Department of Agricultural Research & Education by Dr. S. Ayyappan, Secretary DARE & Director General, ICAR.
- Chairman, Technical Monitoring Committee (TMC) for improvement of Fishery Statistics, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture held on 16 April 2012 at Hyderabad and 28-29 January 2013 at Bhubaneswar.
- Chief Guest in the valedictory function of the training programme on Field Survey, Electronic Compilation and Analysis of Data on 28 July 2012 at NCAP, New Delhi.
- Co-Chair of a technical session on Agricultural Research, Extension and Input Services of 20th Annual Conference and Silver Jubilee of the Agricultural Economics Research Association (AERA) during 09-11 October 2012 at Indian Agricultural Research Institute, New Delhi.
- Co-Chairman of the Organising Committee of the International Conference on Statistics and Informatics in Agricultural Research (ICSI 2012) organized by the Indian Society of Agricultural Statistics (ISAS) during 18-20 December 2012.
- Convener for the Academic Session on Advances in Statistical Genetics held during ICSI 2012 organized by ISAS during 18-20 December 2012.

Dr. VK Gupta

- Member of the Sectional Committee on Social Sciences for selection of suitable candidates for Academy Fellowship/Associateship and the meeting was held during 13-14 September 2012 in the Academy's Secretariat, NASC, New Delhi.
- Chairman of the Organizing Committee of the International Conference on Statistics and Informatics in Agricultural Research organized by the Indian Society of Agricultural Statistics during 18-20 December 2012.
- Delivered an Invited Talk on Combinatorics in Controlled Sampling Designs in a Conference jointly hosted with Madras University and Indian Statistical Institute at Hotel Savera, Chennai during 02-05 January 2013 to celebrate the designation of 2013 as International Year of Statistics by the International India Statistical Association.

- Chairman, Advisory Committee and Executive President of the 15th Annual Conference of the Society of Statistics, Computer and Applications, held at Banasthali Vidyapith during 24-26 February 2013.
 - Delivered Plenary Talk on “Combinatorics in Sample Surveys vis-a-vis Controlled Selection.
 - Chaired the Session on Plenary Talk delivered by Professor Aloke Dey
 - Chaired the Meeting of the Executive Council, General Body Meeting and the Valedictory Session
- Chaired the session during one day seminar on Applied Statistics organized by Bayesian and Interdisciplinary Research Unit, ISI, Kolkata on 22 March 2013.
- Member of the QRT for the National Institute for Animal Nutrition and Physiology, Bangalore.

Dr. UC Sud

- Non-official Member for “Constitution of Working Group for formulating methodology etc. for the 70th Round of NSS” nominated by the Ministry of Statistics and Programme Implementation.
- Chairman, First meeting of the sub-committee constituted on collection of breed-wise information on animals by Department of Animal Husbandry, Dairying & Fisheries (AHS Division), Ministry of Agriculture, GOI.
- Member of a Group constituted by the Department of Animal Husbandry, Dairying & Fisheries (AHS Division), Ministry of Agriculture, GOI for reviewing the annual estimates of milk production in respect of Rajasthan, Himachal Pradesh and Tamil Nadu.

Dr. Rajender Parsad

- Chaired a session of Invited Papers during 15th Annual Conference on Statistics and Informatics in Agricultural Research of Society of Statistics, Computer and Applications organized at Banasthali Vidyapith, Banasthali during 24-26 February 2013.
- Nominated as member, Institute Management Committee of National Bureau of Plant Genetic Resources, New Delhi for the period of three years with effect from 21.02.2013 vide Officer Letter no. 16-14/06-IA.Iv (Pt.) dated 27 February 2013.

Dr. Anil Rai

- Member of RAC of Project Directorate on Animal Disease Monitoring and Surveillance (PD-ADMAS), Bangalore.

Dr. Ranjana Agrawal

- Nominated as member of Governing body of Hindi Academy, Delhi Government, Delhi.

Dr. Seema Jaggi

- Invited as a Panelist in the Planery Session II on Strengthening Agricultural Policy Research during the 20th Annual Conference and Silver Jubilee of the Agricultural Economics Research Association (AERA) India organized by IARI, IASRI and NCAP during 9-11 October 2012 on the theme Agricultural Inputs and Services Delivery System for Accelerating Growth and Improving Farm Income.
- Member Secretary of the sub-committee to look into the possibility of framing rules for the election of Office Bearers of Indian Society of Agricultural Statistics at par with other scientific bodies and for framing guidelines for new Best Paper Award to be instituted for the papers published in the discipline of Statistics with applications in Agricultural Sciences in a Journal suitably identified.

Dr. Hukum Chandra

- Expert Member Core Group, Central Board of Secondary Education (CBSE) Committee on “Finalization of Modalities for Normalization of JEE (Main), 2013”, Govt. of India, 2012-13.
- Expert Member of Core Group, Committee constituted for “Suggesting the Statistical Methodology” to generate data on Student Enrolment, Ministry of Human Resources Development, Govt of India, 2013.
- Member of International Statistical Institute, Netherlands.

Dr. Dinesh Kumar

- Appointed by Board of Directors as Member Board of Studies (BOS) in Biotechnology Engineering in University Institute of Engineering & Technology, Kurukshetra University, for two years for session 2011-12 & 2012-13.

Dr. LM Bhar

- Chaired a session of Contributed Papers during 15th Annual Conference on Statistics and Informatics in Agricultural Research of Society of Statistics, Computer and Applications organized at Banasthali Vidyapith, Banasthali during February 24-26, 2013.

Dr. Anil Kumar

- Acted as a rapporteur in Technical Session on “Climate Change” in National Seminar on “New paradigms in livestock production: From traditional to commercial farming and beyond” on 29 January 2013 at National Dairy Research Institute, Karnal

Dr. N. Okendro Singh

- Awarded for reviewing a research article entitled Analysis of meristic characters among the populations of Japanese threadfin bream, *Nemipterus japonicus* (Bloch, 1791) along Indian coast for Indian Journal of Fisheries.

Offices in Professional Societies/Research Journals

Agricultural Research

Dr. VK Gupta Associate Editor

Annals of Agricultural Research

Dr. Cini Varghese Member, Editorial Board

Bureau of Indian Standards, New Delhi

Dr. VK Bhatia Member, Management and Systems Division Council

Dr. Rajender Parsad Member, Management and Systems Division Council

Committee of the Conference of Central and State Statistical Organizations (COCSSO), Central Statistical Organization, Ministry of Statistics and Programme implementation, GOI

Dr. VK Bhatia Member, Standing Committee

Computer Society of India, Delhi Chapter

Dr. Alka Arora Nomination Committee (NC) Member

Farming Systems Research and Development Association

Dr. Anil Kumar Joint Secretary Member, Editorial Board

Md. Samir Farooqi Member, Editorial Board

**Hindi Academy, Delhi**

Dr. Ranjana Agrawal Member, Governing Body

Indian Society of Agricultural Marketing

Dr. SP Bhardwaj Member, Executive Council

Indian Society of Agricultural Statistics

Dr. VK Gupta Vice President
Chair Editor, JISAS

Dr. VK Bhatia Honorary Secretary
Associate Editor, JISAS

Dr. Rajender Parsad Joint Secretary
Coordinating Editor, JISAS

Dr. PK Malhotra Joint Secretary
Coordinating Editor, JISAS

Dr. UC Sud Member, Executive Council
Associate Editor, JISAS

Dr. Prajneshu Associate Editor, JISAS

Dr. Hukum Chandra Member, Executive Council

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

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. VK Bhatia Member, Governing Body

Dr. UC Sud Member, Governing Body

Dr. Rajender Parsad Member, Governing Body

Dr. Prajneshu Member, Governing Body

International Indian Statistical Association - INDIA Joint Statistical Meeting (IISA-INDIA JSM) 2000 Trust

Dr. VK Bhatia President

International Journal of Agricultural and Statistical Science

Dr. Anil Kumar Member, Editorial Board

International Statistical Institute, Netherlands

Dr. VK Gupta Elected Member

Dr. Rajender Parsad Elected Member

Dr. Hukum Chandra Elected Member

International Journal of Advancements and Developments in Statistical Science

Dr. Hukum Chandra Member Editorial Board

International Journal of Advanced Research in Computer and Communication Engineering

Sh. KK Chaturvedi Member Editorial Board

Journal of Computer Science and Engineering

Sh. KK Chaturvedi Member Editorial Board

International Journal of Emerging Technology & Advanced Engineering

Sh. KK Chaturvedi Member Editorial Board

International Journal of Essential Sciences

Dr. Anil Kumar Member, Editorial Board

Journal of Farming Systems Research and Development

Dr. DR Singh Member, Editorial Board

Journal of Statistical Theory and Practice

Dr. VK Gupta Associate Editor

Dr. Prajneshu Associate Editor

Ministry of Statistics & Programme Implementation

Dr. VK Bhatia 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



Model Assisted Statistics and Applications

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

Pusa AgriScience, Journal of IARI, PG School

Dr. Rajender Parsad Member, Editorial Board

Society for Community Mobilization for Sustainable Development

Dr. Anil Kumar Member, Editorial Board

Society of Statistics, Computer and Applications

Dr. VK Gupta President
Dr. VK Bhatia Vice President
Member, Editorial Board
Dr. Rajender Parsad Executive Editor, Statistics & Applications

Dr. V Ramasubramanian Joint Secretary
Dr. LM Bhar Joint Secretary
Managing Editor, Statistics and Applications
Dr. Alka Arora Associate Editor

Swadeshi Science Movement of Delhi

Dr. Sushila Kaul Member, Executive Council
Member, Editorial Board

University of Kumaun, Nainital

Dr. VK Gupta Member, Board of Studies and Research Degree Committee
Dr. Anil Kumar Member, Board of Studies and Research Degree Committee





Linkages and Collaboration in India and Abroad including Outside Funded Projects

S. No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
ICAR Institutes/ SAUs				
1.	Development of forecasting module for podfly, <i>Melanagromyza obtusa</i> Malloch in late pigeonpea	IIPR, Kanpur	01 July 2007 (01 January 2009)	30 September 2012
2.	Visioning, Policy Analysis and Gender (V-PAGe) - Sub-Programme II: Technology forecasting	NCAP, New Delhi (NAIP Component-I)	01 June 2007	30 June 2012
3.	Visioning, Policy Analysis and Gender (V-PAGe) Sub-Programme III: Policy analysis and market intelligence	NCAP, New Delhi (NAIP Component-I)	01 June 2007	30 June 2012
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 March 2014
6.	Genomics and molecular markers in crop plants (Sub-project 4: Development of new genomic and EST resources and functional genomics of thermotolerance 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
8.	Weed assessment and management in the crops and cropping system	IARI, New Delhi	01 April 2009 (29 December 2010)	31 March 2014
9.	Development of innovative convenience food as protein supplement	IARI, New Delhi	01 April 2009 (24 October 2009)	31 March 2014
10.	Weather based forewarning models for Onion Thrips (<i>Thrips tabaci</i> Lindeman)	DOGR, Pune	01 April 2010	05 March 2013
11.	Weather based forewarning of mango pests	CISH, Lucknow; RFRS, Vengurle; BCKV, Mohanpur; BAC, Sabour; FRS, Sangareddy	01 April 2010	31 July 2013

*Dates within parentheses are the dates of association of IASRI with the project.

S. No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
12.	Establishment of National Agricultural Bioinformatics Grid for ICAR	NBPGR, New Delhi; NBAGR, Karnal; NBFGR, Lucknow NBAIM, Maunath Bhanjan NBAIL, Bangalore (NAIP Component-I)	01 April 2010	31 March 2014
13.	Pest and diseases dynamic vis-a-vis climatic change under the project National Initiative on Climate Resilient Agriculture	NCIPM, New Delhi (NICRA)	01 June 2011	31 March 2017
14.	Development of web based mushroom expert system	DMR, Solan	01 April 2011	30 September 2012
15.	Phenomics of moisture deficit and low temperature stress tolerance in rice	NRCPB, New Delhi IARI, New Delhi Delhi University, New Delhi CRRRI, Cuttack; IGKV, Raipur CAU, Barapani ICAR RC-NEHR, Barapani	15 February 2011	14 February 2016
16.	Study of synonymous codon usage and its relation with gene expressivity in genomes of halophilic bacteria	NBAIM, Mau	01 August 2011	15 April 2013
17.	Enhancing resilience of agriculture to climate change through technologies, institutions and policies	NCAP, New Delhi (NICRA)	29 August 2011	26 August 2014
18.	Efficacy of soil sampling strategies for describing spatial variability of soil attributes	IISS, Bhopal	01 August 2010 (01 November 2011)	30 September 2012
19.	Development of forecasting methodology for fish production from ponds of upland region	DCFR, Bhimtal	20 August 2011	30 April 2013
20.	ePlatform for seed spice growers	NRCSS, Ajmer	17 December 2011	30 September 2013
21.	Strengthening & refinement of Maize AgriDaksh	DMR, New Delhi	01 April 2011	31 March 2016
22.	Implementation of Management Information System (MIS) including Financial Management System (FMS) in ICAR	NAIP Component-I	19 January 2012	31 March 2014
23.	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
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
Government of India				
27.	Whole Genome Association (WGA) analysis in common complex diseases: An Indian initiative	UDSC, NII, Delhi University, AIIMS, DMC (DBT Funded)	29 September 2008	28 September 2013
28.	Experimental designs in the presence of indirect effects of treatments	DST Funded	01 October 2011	30 September 2014
29.	Assesment of quantitative harvest and post harvest losses of major crops/commodities in India	Min. of Food Processing Industries, Government of India	01 February 2012 (01 June 2012)	31 January 2015
30.	Buffalo genome information resource	NDRI, Karnal (DST Funded)	26 March 2012	25 March 2014
31.	Bioacoustics tool: A novel non-invasive approach for different monitoring of health and productivity in dairy animals.	NDRI, Karnal (DBT Funded)	01 February 2013	31 January 2016
32.	A new distributed computing framework for data mining	BITS, Pilani Department of Electronics & Information Technology, Government of India	15 October 2012 (01 November 2012)	14 October 2015



List of Publications

Research Papers

- Aarathi, LR, Kumar, Shiv, Negi, Digvijay Singh and Singh, Dharam Raj (2012). Prevailing standards and dimensions governing sanitary and phyto-sanitary compliance in Indian black pepper. *Agril. Eco. Res. Rev.*, **25(1)**, 69-78.
- Abedinpour, M, Sarangi, A, Rajput, TBS, Singh, M, Pathak, H and Ahmad, T (2012). Performance evaluation of aqua crop model for maize crop in a semi-arid environment. *Agril. Water Manage.*, **110**, 55-66.
- Agrawal, Ranjana, Chandrahas, Aditya, Kaustav. (2012). Use of discriminant function analysis for forecasting crop yield. *Mausam*, **63(3)**, 455-458.
- Ahmad, T, Rai, A and Sahoo, PM (2012). Comparison of bootstrap techniques for estimation of ratio in complex surveys. *Inter. J. Agril. Statist. Sci.*, **8(1)**, 355-365.
- Ahmad, T, Sahoo, PM and Rai, A (2012). Managing agricultural resources. *Geospatial Today*, **11(6)**, 22-25.
- Ahuja, S and Dhanya, C (2012). Regionalization of rainfall using RCDA cluster ensemble algorithm in India. *J. Software Engg. Appl.*, **5(8)**, 568-573.
- Ahuja, S (2012). Regionalization of river basins using cluster ensemble. *J. Water Resour. Prot.*, **4**, 560-566.
- Arivalagan, M, Gangopadhyay, KK, Kumar, Gunjeet, Bhardwaj, Rakesh, Prasad, TV, Sarkar, SK and Roy, A (2012). Variability in minerals composition of Indian eggplant (*Solanum melongena L.*) genotypes. *J. Food Composition Analy.*, **26(1-2)**, 173-176.
- Arora, Sumitra, Kanojia, Ashok K, Kumar, Ashok, Sardana, HR and Sarkar, Susheel Kumar (2012). Impact of biopesticide formulation on tomato (*Lycopersicon esculentum*): Economics and environmental effects. *Ind. J. Agril. Sci.*, **82(12)**, 1075-1078.
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- Ashraf, Jawaid, Jaggi, Seema and Varghese, Cini (2011). Block designs for two non-interacting sets of treatments. *J. Statist. Appl.*, **6(1-2)**, 59-68.
- Bajetha, Garima, Bhati, Jyotika, Sarika, Iquebal, MA, Rai, Anil, Arora, Vasu and Kumar, Dinesh (2013). Analysis and functional annotation of expressed sequence tags of water buffalo. *Anim. Biotech.*, **24(1)**, 25-30.
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- Karan Fries cattle of India. *Ind. J. Anim. Sci.*, **82(11)**, 1377-1380.
- Bharadwaj, Anshu and Minz, Sonajharia (2012). Hybrid approach for classification using support vector machine and decision tree. *Int. J. Adv. Comp. Sci. Appl.*, **2(3)**, 72-76.
 - Bhardwaj, SP (2012). Methodological study of genetic pricing mechanism for Ag-biotech products. *Ind. J. Agril. Econ.*, **67(13)**, 536-537.
 - Bhardwaj, SP, Kumar, Ashok and Singh, KN (2012). Econometric study of asymmetry in price transmission from wholesale to retail trade of sugar. *Economic Affairs*, **57(2)**, 137-146.
 - Bhardwaj, SP, Singh, KN and Kumar, Amrender (2012). Study of performance measures of univariate time series methods for price forecasting - An empirical study of gram price forecast. *Agril. Econ. Res. Rev.*, **25**, 532.
 - Bhati, Jyotika, Chaduvula, Pavan K, Kumar, Sanjeev and Rai, Anil (2013). Phylogenetic analysis and secondary structure prediction for drought tolerant capbinding proteins of plant species. *Ind. J. Agril. Sci.*, **83(1)**, 21-25.
 - Bhushan, Gunjan, Mishra, VK, Iquebal, MA and Singh, YP (2013). Effect of genotypes, reproductive developmental stages and environments on glucosinolates content in rapeseed mustard. *Asian J. Plant Sci. Res.*, **3(1)**, 75-82.
 - Chambers, R and Chandra, H (2013). A random effect block bootstrap for clustered data. *J. Comput. Graphical Statist.*, **22(2)**, 452-470.
 - Chandra, H (2013). Exploring spatial dependence in area level random effect model for disaggregate-level crop yield estimation. *J. Appl. Statist.*, **40(4)**, 823-842.
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 - Chandra, H, Chambers, R and Salvati, N (2012). Small area estimation of proportions in business surveys. *J. Statist. Comput. Simul.*, **82(6)**, 783-795.
 - Chatterjee, Niladri Sekhar, Gupta, Suman and Varghese, Eldho (2013). Degradation of metaflumizone in soil: Impact of varying moisture, light, temperature, atmospheric CO₂ level, soil type and soil sterilization. *Chemosphere*, **90(2)**, 729-736.
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 - Choudhary, AK, Iquebal, MA and Nadarajan, N (2012). Protogyny is an attractive option over emasculation for hybridization in pigeonpea. *SABRAO J. Breed. Genet.*, **44(1)**, 138-148.
 - Choudhary, VK, Kumar, P Suresh, Sarkar, Susheel Kumar and Yadav, JS (2013). Production potential, economic analysis and energy auditing for maize-vegetable based cropping systems in Eastern Himalayan Region, Arunachal Pradesh. *Ind. J. Agril. Sci.*, **83(1)**, 110-115.
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 - Dahiya, Shashi, Jaggi, Seema, Chaturvedi, KK, Bhardwaj, Anshu, Goyal, RC and Varghese, Cini (2012). An eLearning system for agricultural education. *Ind. Res. J. Ext. Edu.*, **12(3)**, 132-135.
 - Dalamu, TK Behera, Varghese, Cini and Khan, Swati (2012). Genetic variability and character association analysis in bitter melon (*Momordica charantia L.*). *Pusa Agri. Science*, **35**, 20-25.
 - Das, Manoranjan, Malhotra, PK, Marwaha, Sudeep and Pandey, RN (2012). Building and querying soil ontology. *J. Ind. Soc. Agril. Statist.*, **66(3)**, 459-464.
 - Das, Shrija, Pareek, Navneet, Raverkar, KP, Chandra, R and Aditya, Kaustav (2012). Effectiveness of micronutrient application and Rhizobium inoculation of growth and yield of chick pea. *Int. J. Agril. Environ. Biotech.*, **5(4)**, 445-452.
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- Gautam, Y, Marwaha, S, Singh, Pal and Shirur, M (2012). Web based expert system on mushroom cultivation. *Ind. J. Mushrooms*, **30(1)**, 34-38.
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- Ratna, Prabha, Singh, Dhananjaya P, Gupta, Shailendra K, Farooqi, Samir and Rai, Anil (2012). Synonymous codon usage in *Thermosynechococcus elongatus* (*cyanobacteria*) identifies the factors shaping codon usage variation. *Bioinformatics*, **8(13)**, 622-628.
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- विजय कुमार भाटिया, सीमा जग्गी एवं विजय बिन्दल। भारतीय कृषि सांख्यिकी अनुसंधान संस्थान के भावी कार्य क्षेत्र - एक अवलोकन, 11-12
- कृष्ण कान्त त्यागी, उमेश चन्दर सूद, विजय बिन्दल एवं अशोक कुमार गुप्ता । स्तरित प्रतिचयन पद्धति, 13-18
- हुकुम चंद्र, उमेश चन्दर सूद, अशोक कुमार गुप्ता, मान सिंह एवं धर्मपाल सिंह । लघु क्षेत्र आकलन विधि-एक अवलोकन, 19-26
- प्रज्ञेषु, सविता वधवा एवं हिमाद्रि घोष । सांकेतिक अंतराल-मूल्यांकित आँकड़ों के लिए रेखीय समाश्रयण मॉडल्स, 27-33
- आर.सी. गोयल, सुदीप, अलका अरोड़ा, प्रदीप कुमार मल्होत्रा एवं रजनी ग्रोवर । भारतीय कृषि अनुसंधान परिषद् में वैज्ञानिकों की छमाही प्रगति मॉनीटरिंग प्रणाली (एच.वाई.पी.एम.), 34-39
- तौकीर अहमद, अनिल राय, प्राची मिश्रा साहू, आभा कान्त एवं मान सिंह । भारत में बागवानी आँकड़ों की वर्तमान स्थिति, 40-45

- हुकुम चन्द्र, उमेश चन्द्र सूद एवं विजय बिन्दल । राष्ट्रीय प्रतिदर्श सर्वेक्षण संगठन के सर्वेक्षणों एवं जनगणना आंकड़ों का संयोजन करके भारत के उत्तर प्रदेश राज्य में जिला स्तर के गरीब परिवारों का आकलन, 46-52
 - अनु शर्मा, सिनी वर्गीस, सीमा जग्गी एवं एस.बी. लाल । आंशिक डायलल क्रासेस की संरचना एवं विश्लेषण के लिए वैब पर आधारित सॉफ्टवेयर, 53-56
 - प्राची मिश्रा साहू, तौकीर अहमद, अनिल राय, नीलम चंद्रा एवं मान सिंह । उत्तर-पूर्वी पर्वतीय क्षेत्र में सुदूर संवेदन, भौगोलिक सूचना तंत्र एवं भूमि सर्वेक्षण आँकड़ों के उपयोग द्वारा फसल क्षेत्रफल का आकलन, 57-62
 - शशि दहिया, आर.सी. गोयल, सीमा जग्गी, के.के. चतुर्वेदी, अंशु भारद्वाज, सिनी वर्गीस एवं ऊषा जैन । कृषि शिक्षा हेतु ई-लर्निंग पद्धति का विकास, 63-66
 - अनिल कुमार, संजीव पंवार, विपिन कुमार चौधरी, धर्मराज सिंह, शिव कुमार एवं प्रवीण आर्य । फसल प्रणाली अनुसंधान प्रयोगों का डिजाइन एवं सांख्यिकीय विश्लेषण, 67-73
 - हुकुम चंद्र, उमेश चन्द्र सूद, अशोक कुमार गुप्ता, कौस्तव आदित्य, मान सिंह एवं धर्मपाल सिंह । आर सॉफ्टवेयर - एक अवलोकन, 74-80
 - एस.बी. लाल, अनु शर्मा एवं अनिल राय । फाइलोजेनेटिक विश्लेषण हेतु सॉफ्टवेयर एवं उपकरण, 81-85
 - नाओरेम ओकेन्द्रो सिंह, अमृत कुमार पॉल, पाल सिंह एवं वसी आलम । मोनोकल्चर और पॉलीकल्चर प्रणाली के तहत टोर पुटीटोरा (हैमिल्टन) मछली के विकास का अध्ययन एवं मूल्यांकन, 86-88
 - धर्मराज सिंह, अरूण जी., शिव कुमार, अनिल कुमार, एस. पी. भारद्वाज, के.एन. सिंह एवं प्रवीण आर्य । तमिलनाडु में जल उपभोक्ता संस्थाओं में किसानों की सहभागिता एवं इसका नहरी जल उपयोग में दक्षता एवं समानता पर प्रभाव, 89-95
 - तौकीर अहमद, अनिल राय, प्राची मिश्रा साहू एवं मान सिंह । बागवानी फसलों के क्षेत्रफल एवं उत्पादन के आकलन हेतु एक वैकल्पिक पद्धति की आवश्यकता, 96-101
 - अमृत कुमार पॉल, संत दास वाही, विजय पाल सिंह, वसी आलम एवं नाओरेम ओकेन्द्रो सिंह । पशु डेरी में असंतुलन आँकड़ों के लिए स्टेबिलिटी की वंशागतित्व के अनुमान की विभिन्न प्रक्रियाओं की आनुभविक तुलना, 102-109
 - अंशु भारद्वाज, शशि दहिया, रजनी जैन एवं ऊषा जैन । कृषि आँकड़ा-समूहों के वर्गीकरण हेतु विविक्तीकरण आधारित सपोर्ट वेक्टर मशीन, 110-118
 - मीर आसिफ इकबाल, सारिका एवं सुशील कुमार सरकार । देश में मसूर उत्पादन का अरैखिक विकास प्रतिमानों के द्वारा वर्णन, 119-124
 - वसी आलम, ए.के. पॉल, प्रवीण आर्य, नाओरेम ओकेन्द्रो सिंह एवं आर.के. पॉल । नियंत्रित अवलोकनों के अन्तर्गत उत्तरजीविता फलन का आकलन, 125-127
 - सुरेन्द्र सिंह, कमलेश नारायण सिंह, अशोक कुमार एवं संजीव पंवार । अरेखीय मॉडलों द्वारा वनराजा पक्षियों के विकास का अध्ययन, 128-130
 - वसी आलम, नवीन एन.सी., धर्मराज सिंह, ए.के. पॉल, नाओरेम ओकेन्द्रो सिंह एवं आर.के. पॉल । कपास की सफेद-मक्खी कीट की रोकथाम के लिए कीटनाशकों के मूल्यांकन हेतु समय-एकीकृत अप्राचालिक सिद्धांत, 131-133
 - ऊषा जैन । संस्थान की राजभाषा यात्रा : 2012-13, 134-136
- Other Popular Article**
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Other Periodic Publications

- Annual Report of the Institute, 2011-12
- IASRI News (published quarterly)
- सांख्यिकी-विमर्श 2012-13, अंक-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 6).

FAO Consultancy

- Consultancy was provided to the Bangladesh Bureau of Statistics, Bangladesh in planning, organization of crop yield estimation survey.

Advisory Services Provided

- Ms. Sini Thomas, student, Division of Plant Physiology, IARI on the use of three factor ANOVA for comparing the effect of magnetopriming on growth and yield of chickpea under salinity.
- Dr. Swaran Lata, Associate Professor, Department of Crop Improvement, CSKHPKV, Palampur on estimating genotypic and phenotypic variance-covariance matrix, genotypic and phenotypic correlations, estimates of heritability and co-heritability and path analysis from the data on 13 characters generated from designed experiment on 40 cultivars conducted using an alpha design in 3 replications and 5 blocks of size 8 per replication.
- Sh. Kiran Kumar, M.Sc. student (Microbiology) on the use of dice coefficient for assessing the similarity among different soils based on the presence or absence of fatty acids.
- Sh. Manoj Kumar, Scientist, CIAE, Bhopal on the application of artificial neural networks for detecting

pattern in the mechanization status of soybean-wheat cropping pattern for different farm operation in Bhopal region.

- Ms. Meena Vidhani, Ph.D. student of Department of Physical Planning, School of Planning and Architecture, New Delhi to examine the prosperity of six newly developed towns (Kalyani, Bidhan Nagar, Mariamalai Nagar, Noida Gurgaon and Navi Mumbai) on the basis of seven factors affecting the performance of new towns.
- Dr. Charanjit Kaur, Professor, Division of Post-harvest Technology, IARI, New Delhi on the analysis of Box-Behnken design to study the effect of enzyme concentration, incubation temperature and extraction time for the enhanced juice yield and recovery of total anthocyanins from black carrot. Further, multi-response optimization technique was suggested to identify the optimum input combination for the maximum juice yield and total anthocyanine content.
- Dr. SV Singh, Principal Scientist and Head, Animal Health Division, Central Institute for Research on Goats, Makhdoom, UP, relating to planning and execution of sample survey to be conducted in a new project proposal.
- Sh. Rajeev Dhiman, Department of Crop Improvement, CSK Himachal Pradesh Krishi Vishwavidyalaya, Palampur on the analysis of data of an experiment conducted using an alpha design with 64 genotypes in 3 replications. Each replication having 8 blocks of size 8 each. The experiment was

conducted during 2010 and 2011. He was advised on performing analysis of variance, obtaining estimates of genotypic coefficient of variation, phenotypic coefficient of variation, environmental coefficient of variation, heritability and genetic advance for 11 parameters. He was also advised on SAS code for performing path analysis.

- Dr. Anchal Dass Atri, Scientist, Agronomy on the analysis for two years data on yield of experiment having 12 treatments under SRI method and two under conventional method of rice culture (12+2=14 treatments).
- Dr. Deependra Singh Yadav, Scientist, NRC Grapes on pair wise comparison of treatments after performing Analysis of Covariance.
- Sh. Yathish Kumar, Scientist Division of Genetics and Plant Breeding, DMR, New Delhi on the use of Jaccard's coefficient for clustering the genotypes based on marker data. Further, a program was written using SAS IML for calculating Polymorphism Information Content (PIC) for finding out the robustness of each of the marker.
- Sh. Ajit Sharma, Student, M.Sc. (Statistics), Deptt. of Basic Science, College of Forestry, Dr. YS Parmar University of Horticulture and Forestry, Naini- Solan (HP) for data analysis and suggested some nonlinear statistical growth models for Statistical investigation on prediction models with important fruit crops of Himachal Pradesh.

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QRT, RAC, Management Committee and IRC

Quinquennial Review Team (QRT)

Quinquennial Review Team (QRT) to review the work done by the Indian Agricultural Statistics Research Institute for the period 01 January 2006 to 31 March 2011 was constituted vide Council's Office Order No. 5-10/2011-IA-II(AE) dated 29 June, 2011. The composition of the QRT is:

Dr. Padam Singh Chairman

Former Member, National Statistical Commission and Head Research and Evaluation, EPOS Health Consultants (India) Pvt. Ltd. 445, Phase-III, Udyog Vihar, Gurgaon, Haryana

Dr. SK Das Member

Director General Central Statistical Office Ministry of Statistics and Programme Implementation, Sardar Patel Bhawan Parliament Street, New Delhi

Dr. GM Saha Member

Visiting Professor Bayesian and Interdisciplinary Research Unit, Indian Statistical Institute 203, Barrackpore Trunk Road Kolkata-700 108, West Bengal

Prof. Karmeshu Member

Professor, School of Computer and Systems Sciences Jawaharlal Nehru University New Delhi-110 067

Dr. RPS Malik Member

Senior Researcher, IWMI-India II Floor Office, Block-B NASC Complex, DPS Marg Pusa, New Delhi-110 012

Dr. TR Sharma Member

Principal Scientist National Research Centre on Biotechnology Lal Bahadur Shastri Building Pusa Campus, New Delhi-110 012

Dr. KN Singh Member Secretary

Head, Division of Forecasting and Econometric Techniques IASRI, Library Avenue, Pusa New Delhi-110 012

A number of meetings of the QRT were held during the period under report. The Committee submitted its final report to the Council and presented it before the Hon'ble DG (ICAR). The final recommendations of the QRT were received from the Council vide letter no. 5-10/2011-IA-II (A.E.) dated 06.12.2012

Approved Recommendations of the QRT

1. The scientists working in the core areas of statistics may be sent for training to International Institutes of repute. As far as feasible, the young scientists should attend more long term trainings abroad and in India and should be encouraged to apply for such funding from different funding agencies of GOI.

2. It is matter of satisfaction that a few scientists of the Institute have been sent for training in the area of bioinformatics, geo-informatics and technology forecasting through National Agricultural Innovation Project. The QRT desired that these efforts should continue in future also.
3. At present, Institute conducts post graduate teaching in collaboration with PG School, IARI, New Delhi. The students admitted mostly have graduate degree in Agricultural Sciences. The students with B.Sc. Mathematics/ Statistics/ Computer Science as one of the subjects are at disadvantageous position as they need to spend one extra year to complete deficiency courses in Agriculture to complete their Master/s degrees. Further, number of seats offered in each courses are few. As a consequence, the manpower requirements in NARS, Government and Private Sector in Agricultural Statistics and Informatics are not met. To attract talent, the students having B.Sc. with Mathematics/Statistics/ Computer Science should be encouraged with provision to complete their degrees in stipulated time without devoting additional year for remedial courses in agriculture.
4. Human resource especially trained in the discipline of Computer Science/ Computer Application is required for undertaking research in the wide gamut of knowledge management and statistical computing. The discipline of Computer Application in the ARS is very important and will continue to be relevant as far as research programmes of ICAR Institutes are concerned. This will also be very important factor in the new IPR regime and changing global scenario. In view of this, direct recruitment in the discipline of Computer Application in Agriculture must be restarted in the ARS.
5. The work in the computer division needs to be reoriented towards problems in “Data Analytics” which is unavoidable in view of enormous amount of data being generated in agriculture including meteorology and environment. It may be mentioned that Data Analytics is currently an important topic for researchers. The data could be potentially analyzed to meet the expectations of agricultural scientists and policy planners. This requires developing intelligent and imaginative techniques for efficiently storing accessing, and processing the data, and most importantly, analytics for inference, alerts, and decisions. Further the group should take up the problems in development of algorithms for statistical computing to keep pace with the peers in the field.
6. The Council may be approached to enhance the Plan fund allocation for the Institute. This is required as several of the research and service activities that have been initiated in the recent past are needed to cater to the requirements of whole NARS. The activities such as Strengthening Statistical Computing for NARS, Strengthening of National Agricultural Bioinformatics Grid and Research in Computational Biology in Agriculture; Statistical Genetics; Strengthening of MIS of ICAR; Strengthening of Data Centre of ICAR etc. are to be taken up in network mode.
7. The Institute should take more proactive steps to harness the opportunities given under the NAIP, particularly Strengthening Statistical Computing for NARS and Establishment of National Agricultural Bioinformatics Grid in ICAR (NABG) through Centre for Agri-Bioinformatics which provide an opportunity to the Institute to contribute in these areas.
8. The Design Resources Server has been helpful in establishing linkages with scientists in NARS. Possibility to extend this further to other disciplines like sample surveys, forecasting, statistical genetics, and statistical modeling should be explored.
9. The availability of the high performance computing facilities, both in terms of hardware and software at IASRI, the Institute has an opportunity to undertake research in handling massive data sets for analysis. Data analytics is another area where the Institute can venture into.
10. Climate change and its impact on agriculture need to be explored. The Institute has an opportunity to develop statistical techniques for studying the implications of climate change and other natural hazards.
11. The basic research in statistics is of paramount importance to handle the statistical issues of agricultural sciences. Therefore, impetus and special emphasis is required on basic research especially on development of new statistical methodologies through basic research. For this, the institute should first identify the scientists who capable of publishing in high impact statistical journals and assign them the major responsibility of developing statistical techniques, tools and new



methodologies for solving emerging problems in agricultural statistics. Such scientists can form a distinct group within the institute and their work will only contribute to strengthening the work in other divisions engaged in applied statistics in a fundamental way. Thus a Division may be created in addition to the existing six Divisions of the Institute, which may be named as Division of Basic Research and Training or Division of Research Methodology and Statistical Techniques.

12. There is overlapping in the work of Forecasting and Econometrics Division of Statistical Modelling work in the Division of Biometrics and Statistical Modelling. It is suggested that these activities could be combined and Division of Forecasting and Econometrics be named as Division of Forecasting and Agricultural Systems Modelling. The Division of Biometrics and Statistical Modelling has been doing good amount of research work in Statistical Genetics. In fact Statistical genetics has been the stronghold of this Institute and historically, Statistical Genetics has been one of the important specializations along with Design of Experiments and Sample Surveys. It will continue to be an important discipline in future as well. In view of this fact, the activities relating to Statistical Genetics in the Division of Biometrics and Statistical modeling should be in new Division with name changed to Division of Statistical Genetics.

Research Advisory Committee (RAC)

The composition of Research Advisory Committee (RAC) of the Indian Agricultural Statistics Research Institute constituted for a period of three years w.e.f. 22 June 2010 is as follows:

Prof. Prem Narain Former Director, IASRI 27 A, Pocket B-3, Lawrence Road Delhi-110 035	Chairman
Dr. GM Boopathy Deputy Director General National Accounts Division Central Statistical Organization Sardar Patel Bhavan, Parliament Street New Delhi-110 001	Member
Dr. SC Gulati Former Professor Population Research Centre B-15, Kirti Nagar, New Delhi-110 015	Member

Dr. Sridhar Sivasubbu Member
Institute of Genomics and
Integrative Biology, IGIB Extension
Center at Naraina
IA, 93-94, Naraina Indl. Area, Phase-I
Naraina, New Delhi-110 028

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

Dr. VK Bhatia Member
Director, IASRI (till 28.02.2013)
Library Avenue, Pusa
New Delhi-110 012

Dr. NPS Sirohi Member
Assistant Director General (Engg.)
Indian Council of Agricultural Research
Krishi Anusandhan Bhavan-II, Pusa
New Delhi-110 012

Dr. Rajender Parsad Member Secretary
Head, Division of Design of Experiments
IASRI, Library Avenue
Pusa, New Delhi-110 012

The 14th meeting of the Research Advisory Committee of IASRI was organized on 30 January 2013 under the Chairmanship of Dr. Prem Narain, Former Director, IASRI, New Delhi. The meeting was attended by Dr. SD Sharma, Former Director, IASRI, New Delhi and Vice-Chancellor, Dev Sanskriti Vishwavidyalaya, Haridwar; Dr. VK Bhatia, Director, IASRI; Dr. GM Boopathy, Deputy Director General, National Accounts Division, Central Statistical Organization, New Delhi; Dr. Sridhar Sivasubbu, Institute of Genomics and Interactive Biology, New Delhi; Dr. NPS Sirohi, ADG (Engg.), ICAR and Dr. Rajender Parsad, Head, Division of Design of Experiments, IASRI, New Delhi. Dr. VK Gupta, National Professor, ICAR and all Heads of Divisions, All Professors and Incharge, PME Cell of IASRI also attended the meeting as special invitees.

Dr. VK Bhatia, Director, IASRI introduced the Honorable Chairman and other members of the RAC and welcomed all members of the RAC. Thereafter, he apprised the members with the important activities of the Institute. After Chairman, Members and National Professor remarks, Dr. Seema Jaggi, In-charge, PME Cell presented the historical development, genesis, functions,

research achievements and future research programmes of the Institute. She spelled out the changes made in Goal, Vision, Mission, Mandate and six research programmes of the Institute for the XII Plan. She also presented the 78 research projects in which scientists of the Institute were involved during the year. She apprised the members regarding 19 completed research projects and 22 new projects undertaken during the period. It was also informed that the Institute has submitted applications to the Registrar, Office of Copyrights, New Delhi for registration of copyright for Monograph on Hadamard Matrices and Monograph on α -designs this year. Institute has submitted applications to the Registrar, Office of Trade Mark, New Delhi for registration of Trade Mark for AGRIdaksh. She also presented the recommendations of QRT for the period 2006-2011. Further, she presented the broad plan budget outline for XII Five Year Plan. She also highlighted the awards and recognitions won by the scientists of the Institute. Dr. VK Bhatia, Director, IASRI received Dr. C Subramaniam Award for Outstanding Teacher in Agriculture and Allied Sciences 2011 for excellent teaching in the field of Social Sciences on 16 July 2012 at the Foundation Day of the Indian Council of Agricultural Research. Two scientists have received Fellowship of Indian Society of Agricultural Statistics; one scientist was elected as Fellow of National Academy of Agricultural Sciences; one scientist was conferred the title of Sankhyiki Bhushan by Indian Society of Agricultural Statistics (ISAS); one scientist received Professor PV Sukhatme Gold Medal Award 2012 from ISAS; one Scientist received Dr. DN Lal Memorial Lecture Award from ISAS; one scientist received Dr. GR Seth Memorial Young Scientist Award from ISAS; one scientist has been elected as Member of International Statistical Institute. 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.

The details of the training and teaching activities of IASRI were presented by Dr. PK Malhotra. It was informed that during the year 03 Ph.D. (Agricultural Statistics), 09 M.Sc. (Agricultural Statistics) and 04 M.Sc. (Computer Application) students have completed their respective degrees. Dr. Eldho Varghese was awarded IARI Merit Medal in the Golden Jubilee Convocation of Indian Agricultural Research Institute for his outstanding

research during Ph.D. A land mark event is that the Ph.D. programme in Computer Application has been approved by Academic Council of PG School, IARI, New Delhi and this programme would start from academic session 2013-14 and onwards. It was also informed that during the year 352 researchers have been trained through various training programmes.

Dr. VK Gupta, ICAR National Professor apprised about the research activities of the National Professor Scheme. He informed the house that during the year, he has published a book on Combinatorics in Sample Surveys vis-à-vis Controlled Selection through Lambert Academic Publishing, Germany. He explained the need, applications and research achievements on supersaturated designs specially k-circulant designs, designs for biological assays and calibrated approach for estimation of population parameters. He also informed that Sample Survey Resources server has been initiated with the help of colleagues from Division of Sample Survey and Design of Experiments for providing e-learning and e-advisory resources.

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 discussions, the following action points emerged:

1. The Institute should concentrate its efforts on development and dissemination of efficient design of experiments, statistical analytical techniques for innovative applications in agricultural sciences, new and efficient algorithms for bioinformatics and knowledge management of NARS. Training programmes and dissemination workshops at the doorstep of the users need to be continued for dissemination of advances in statistics and informatics.
2. Proactive interaction with the researchers of NARS has helped in identification of statistical researchable issues and in taking up collaborative research programmes. These efforts need to be formalized through subject matter Divisions. National Conference of Agricultural Research Statisticians may

- be organized biennially with subject matter divisions of the Council for the identification of researchable issues.
3. For enhancing the capabilities of scientists and providing an international exposure, the scientists in the core areas of statistics may be sent for training to International Schools of repute. Besides the resources from the Council, different Government of India agencies such as DST/DBT/CSIR/INSA may be approached for training the scientists.
 4. Good provision of capacity building of Scientists in Bioinformatics has been kept in XII plan. For training the scientists, a list of topics of the specific requirement of NARS may be identified and as per requirement the schools of repute may be identified. The scientists should be sent for training in these areas only rather than sending them for training in generic areas.
 5. The efforts on strengthening the Web Resources on Design of Experiments and Sample Surveys have enhanced the visibility of the Institute at global level. These efforts need to be pursued rigorously. Web Resources must be replicated in other areas such as Statistical Modelling and Statistical Genetics.
 6. Indian NARS Statistical Computing Portal established for providing service oriented computing through IP Authentication for the researchers of NARS has been immensely useful to the researchers in NARS. Adding more modules of analysis on this portal should be a continuing activity so as to culminate into a service oriented computing resource for standardization of statistical analysis of data generated by researchers in Indian NARS and facilitate customized modules for automation of one-two AICRPs/Network Projects.
 7. The efforts for development of statistical methodologies for using Remote Sensing Data to obtain estimates of parameters of interest are significant. Some studies should also be initiated to see whether the use of Remote Sensing and GIS can be helpful in reducing the sample size for crop cutting experiments.
 8. The data repository steps in National Agricultural Bioinformatics Grid should be automated without involvement of subject matter specialist. Further, the efforts should be made to conduct basic research and methodological development, development of generic tools, algorithm, etc. in bioinformatics.
 9. More efforts may be made to disseminate the research achievements of the Institute in small area estimation to State Department of Agriculture and Planning Commission.
 10. Vacant scientific positions at IASRI should be filled on priority basis and for this the concerned authorities may be approached. Efforts may be made to revive the direct recruitment at scientist level in the discipline of computer applications which has also been recommended by the QRT.
 11. PG School, IARI, New Delhi and Deputy Director General (Education) Indian Council of Agricultural Research should be approached 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. The committee also felt that the number of seats in these programmes must be increased. From this year onwards, the qualifications in ARS are M.Sc. in Agricultural Statistics/Biostatistics/Statistics with specialization in Agriculture. As statistical tools can be applied in any area of science and looking into the large number of vacant positions and for attracting the talent from outside the system, efforts should be made for dropping of "with Specialization in Agriculture" from the qualifications. The members strongly felt that the Institute should get a Deemed University status and felt satisfaction that QRT for the period 2006-2011 has also made the same recommendation. The Institute should make efforts to get the Deemed University Status.
 12. The list of Core Activities and Service Activities such as Indian NARS Statistical Computing Portal, National Agricultural Bioinformatics Grid, FMS/MIS, HYPM, etc. may be prepared. To run the service activities 24 x 7, technical manpower is must. The Council may be requested to allow to fill the vacant positions of Technical Personnel as a special case.
 13. 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. The present Institute Management Committee comprises of:

Dr. VK Bhatia Director, IASRI (ICAR), Pusa New Delhi-110 012	Chairman (till 28.02.2013)
Dr. UC Sud Director (A), IASRI (ICAR), Pusa New Delhi-110 012	Chairman (w.e.f. 01.03.2013)
Dr. Suresh Pal Head, Division of Agricultural Economics, IARI New Delhi-110 012	Member
Dr. (Smt.) Ravindra Kaur Project Director Water Technology Centre, IARI New Delhi-110 012	Member
Dr. (Smt.) Rajni Jain Senior Scientist NCAP, New Delhi	Member
Dr. Niranjana Prasad Head, Division of Processing and Product Development IINRG, Ranchi	Member
Dr. NP Sirohi Assistant Director General (Engg.) KAB-II, ICAR, Pusa New Delhi-110 012	Member
Sh. KPS Gautam Chief Administrative Officer IASRI (ICAR) New Delhi-110 012	Member Secretary

The 61st meeting of Institute Management Committee was held on 22 February 2013 at the Institute.

At the outset, Dr. VK Bhatia, Director, IASRI, New Delhi and the Chairman of the Management Committee welcomed all the distinguished members and special

invitees present in the meeting and also introduced newly nominated members Dr. (Mrs.) Ravinder Kaur, Project Director, Water Technology Centre, IARI and Dr. Niranjana Prasad, Head, Division of Processing and Production Development, IINRG, Ranchi.

Dr. Seema Jaggi, Incharge (PME) made presentation on Institute Research Committee. She also presented Research Achievements on the completed research projects and on-going projects at IASRI. Dr. Rajender Parsad, Head (DE) and Member Secretary, RAC gave presentation on Research Advisory Committee recommendations of the Institute. Dr. PK Malhotra, Professor (Computer Applications) and Incharge, Training & Administration Cell gave presentation on Teaching and Training Activities of the Institute and Dr. KN Singh, Secretary, QRT presented recommendations of QRT Report of the Institute.

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.

Two (77th & 78th) meetings of the Institute Research Committee (IRC) were held during 19-22 September 2012 and 25-26 March and 01-02 April 2013. In the 77th meeting 06 new research projects (04 Institute funded and 02 outside funded) were approved and progress of 56 on-going research projects (28 Institute funded, 15 in collaboration with other Institutes and 13 outside funded) were discussed and 07 research projects were declared as completed. In the 78th meeting 06 new research projects (04 Institute funded and 02 outside funded) were approved and progress of 48 on-going research projects (27 Institute funded, 10 in collaboration with other Institute and 11 outside funded) was reviewed and 07 research projects were declared as completed.

During the year, 12 new research projects were approved and progress of 104 on-going research projects was reviewed and 14 research projects were declared complete.





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

PAPERS PRESENTED

- **42nd Annual Sorghum Group Meeting held at GB Pant University of Agriculture and Technology, Pantnagar during 28-30 April 2012**
 - Parsad, Rajender. Statistical issues in designing of experiments and analysis of experimental data for multi environment trials (Invited talk).
- **Global Conference on Horticulture for Food Nutrition and Livelihood Options held at Bhubaneswar, Orissa during 28-31 May 2012**
 - Salvi, MB, Agrawal, Ranjana*, Salvi, BR, Mishra, AK, Pandey, G and Chandra, Rakesh. Forewarning powdery mildew of mango (*Mangifera indica* L.) caused by *Oidium mangiferae* Berthet.
- **2nd Institute of Mathematical Statistics Asia Pacific RIM Meeting held at Tsukuba, Japan during 02-04 July 2012**
 - Parsad, Rajender*, Dash, Sukanta and Gupta, VK. Efficient row-column designs for 2-colour single factor microarray experiments. (Invited talk)
- **14th Annual Conference of Society of Statistics and Computer Application and 1st International Conference on Mathematics and Mathematical Sciences at Molecular Marg, Lodhi Road, New Delhi during 07-08 July 2012**
 - Panwar, Sanjeev*, Kumar, Anil, Singh, KN and Sivaramane, N. Growth rates of rice yield through non-linear models.
 - Kumar, Anil and Panwar, Sanjeev*. Identification of best crop sequence for getting maximum and consistent net returns and energy equivalents.
- **International Conference on Advances in Electronics, Electrical and Computer Science EEC'2012 at Dehradun, Uttarakhand during 07- 09 July 2012**
 - Dahiya, Shashi*, Goyal, RC, Arora, Alka, Pal, Soumen, Singh, Pal, Grover, Rajni B and Gupta, PL. An online management and decision making resource for agricultural education in India.
 - Bharadwaj, Anshu* and Minz, Sona Zharis. Hybrid approach to classification using SVM and decision tree.
- **22nd Colombian Symposium in Statistics at Bucaramanga, Colombia during 17-21 July 2012**
 - Chandra, H* and Sud, UC. Small area estimation under geographically weighted area level model. (Invited talk)
- **National Conference on New Trends in Bioinformatics at IIT, Delhi during 30-31 July 2012**
 - Dash, Manoswini, Challam, Clarissa, Sahu, TK, Ghosh, Tapu, Tyagi, Wricha, Rai, Mayank and Rao, AR*. Identification and analysis of SNPs in DREB genes of rice cultivars grown in NE-hill region. (poster presentation)
 - Chilana, Poonam, Sharma, Anu*, Arora, Vasu, Rao, Ekta and Rai, Anil. Computational identification of putative miRNAs and their

- characterization in *Heliothis virescens*. (poster presentation)
- **National Conference on Agro-Informatics and Precision Agriculture-2012 organized at IIIT, Hyderabad during 01-03 August 2012**
 - Dahiya, Shashi. Agricultural knowledge management using an e-platform.
 - Sudeep. Agridaksh - A tool for developing online expert system.
 - Bharadwaj, Anshu. Geo-informatics in precision agriculture - Statistical aspect.
 - **13th International Pure Mathematics Conference 2012 organised at Islamabad, Pakistan during 02-03 September 2012**
 - Prajneshu. Some parametric nonlinear time-series models and their applications in agriculture. (Invited talk)
 - **6th CSI-IEEE International Conference on Software Engineering (CONSEG-2012) held at DAVV Indore (MP) during 05-07 September 2012**
 - Chaturvedi, KK* and Singh, VB. Determining bug severity using machine learning techniques.
 - **National Workshop on Improvement of Agricultural Statistics organized by Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India at NASC Complex, New Delhi during 19-20 September 2012**
 - Chandra, Hukum* and Sud, UC. Disaggregate level crop yield estimation using small area estimation techniques. (Invited talk)
 - Ahmad, T*, Bhatia, VK, Sud, UC, Rai, A and Sahoo, PM. An alternative sampling methodology for estimation of cotton production.
 - **VI International Conference on Legume Genetics and Genomics held at Hyderabad during 02-07 October 2012**
 - Singh, Nishtha, Sahu, Tanmaya K, Singh, UP, Gaikwad, Kishore, Singh, NK and Rao, AR*. Computational analysis of Heat Shock Proteins (HSPs) to understand the molecular mechanism of heat stress tolerance in legumes and other plant species. (Oral and poster presentation).
 - **20th Annual Conference and Silver Jubilee of the Agricultural Economics Research Association (AERA) India held at Division of Agricultural Economics, Indian Agricultural Research Institute, New Delhi during 09-11 October 2012**
 - Jaggi, Seema. Statistics: Tool for agricultural policy research. (Invited talk)
 - Bhardwaj, SP. Study of performance measures of univariate time series methods for price forecasting- An empirical study of gram price forecast.
 - Arun, G, Singh, Dharam Raj*, Kumar, Shiv and Kumar, Anil. Canal irrigation management through water users associations and its impact on efficiency, equity and reliability in water use in Tamil Nadu.
 - **National Conference on Managing Threatening Diseases of Horticultural, Medicinal, Aromatic and Field Crops in Relation to Changing Climatic Situation at IISR Lucknow during 03-05 November 2012**
 - Agrawal, Ranjana*, Dalvi, MB, Ray, SK, Sharma, Hemant, Pandey, G, Chandra, Rakesh and Misra, AK. Forewarning powdery mildew in Mango. (Theme paper)
 - **XXX Workshop of AICRP on Integrated Farming Systems during 16-19 November 2012 at ICAR Research Complex for Goa**
 - Kumar, Anil*, Varghese, Eldho and Parsad, Rajender. Progress of the project of OSR experiments and the layout plan randomization procedure for climate change experiment.
 - **National Conference on NexGen Biotechnology: Amalgamating Science and Technology organized at Kurukshetra University during 23-24 November 2012**
 - Iquebal, MA, Sarika, Arora, V, Verma, N, Rai, A and Kumar, Dinesh*. World's first whole genome based microsatellite DNA marker database of tomato: TomSatDB.
 - **6th International Conference on Quality, Reliability, Infocomm Technology and Industrial Technology Management (ICQRITIM 2012) at University of Delhi, Delhi during 26-28 November 2012**
 - Chaturvedi, KK*, Kapur, PK, Singh VB and Anand, Samir. Predicting software change complexity using entropy based measures.
 - **3rd International Agronomy Congress on Agricultural Diversification, Climate Change Management and Livelihoods organized at IARI, New Delhi during 26-30 November 2012**

- Kumar, Anil*, Kumar, Pramod, Singh, Gyan, Panwar, Sanjeev and Choudhary, Vipin Kumar. Application of multivariate analysis for economic evaluation of cycles of different crop rotations.
- **12th International Conference of Hybrid Intelligent Systems (HIS) at MIT College of Engineering, Pune during 05-06 December 2012**
 - Sudeep. Decision support system for research project duplication detection.
- **National Symposium on Space Technology for Food & Environment Security' & Annual Convention of Indian Society of Remote Sensing & Indian Society of Geomatics at IARI, New Delhi during 05-07 December 2012**
 - Sahoo, PM*, Ahmad, T, Singh, KN and Rai, A. Generation of cloud free satellite images using geospatial technology.
- **International Consultative Meeting on Seribiotechnology 2012 (ICMS 2012) at DBT Institute IBSD at IITG, Imphal Manipur during 05-07 December 2012**
 - Kumar, Dinesh. Global mapping of Intellectual property of silk genome and its products challenges and issues for India. (Invited lead paper)
- **International Symposium on Bioengineering in 2012 at IIT, Guwahati on 10 December 2012**
 - Kumar, Dinesh. Bioinformatics tools for genome annotations. (Invited talk)
- **66th Annual Conference of ISAS as International Conference on Statistics and Informatics in Agricultural Research at IASRI, New Delhi during 18-20 December 2012**

Invited Papers

- Agrawal, Ranjana and Kumar, Amrender*. Models for forecasting crop yields, pests and diseases: IASRI approaches.
- Chandra, Hukum*, Gharde, Yogita and Jain, VK. Small area prediction under unit level model using estimated auxiliary data.
- Devakumar, C* and Gupta, VK. Pedagogical issues in statistics education.
- Gaur, HS* and Parsad, Rajender. Policy issues for HRD in agricultural statistics and informatics.

- Ghosh, Himadri. Some stochastic volatility models and their applications.
- Kaul, Sushila. Data requirement for study of women in Indian agriculture.
- Prajneshu. Human resource development (HRD) in agricultural statistics: Current status and challenges
- Rai, Anil. National agricultural bioinformatics grid.
- Sud, UC*, Chandra, Hukum and Gupta, VK. On calibration approach based product estimator.

Contributed Papers

- Aditya, Kaustav*, Sud, UC and Chandra, Hukum. Estimation of domain total for unknown domain size in the presence of nonresponse.
- Ahmad, Tauqueer*, Bathla, HVL, Rai, Anil, Sahoo, Prachi Misra, Gupta, AK and Jain, VK. Statistical evaluation of methodology for estimation of cotton production in India.
- Ahuja, Sangeeta. Statistical package for agricultural research - Version 3.0 (SPAR 3.0).
- Alam, Wasi*, Paul, AK, Singh, NO and Singh, Pal. Maximum likelihood and uniformly minimum variance unbiased estimation of $P(Y < X)$ for Gompertz distribution.
- Arora, Alka*, Malhotra, PK, Goyal, RC and Sudeep. Approach for duplication detection in research project documents.
- Arya, Prawin, Sivaramane, N, Singh, DR* and Kumar, Anil. Vertical Integration of value-chain in edible oils markets in India
- Bharadwaj, Anshu*, Islam, SN and Singh, DR. OLAP cubes construction of 61st round NSSO data using multidimensional modeling
- Bhowmik, Arpan*, Jaggi, Seema, Varghese, Cini and Varghese, Eldho. Trend resistant second order neighbour balanced block designs.
- Biswas, Ankur*, Rai, Anil and Ahmad, Tauqueer. Spatial estimation procedure for agricultural surveys.
- Chandra, H. Some innovative approaches for small area estimation. (Dr. DN Lal Memorial Lecture).
- Chaturvedi, KK*, Rai, Anil and V, Ramasubramanian. Decision support system for insurance products for agriculture.

- Dahiya, Shashi*, Bharadwaj, Anshu, Narwal, Sneha and Bajpai, Shalini. Online software for decision tree classification using simple CART.
- Dasgupta, Pratyush* and Bhar, Lal Mohan. Robustness of balanced incomplete block designs for multi-response experiments against missing data.
- Dash, Sukanta*, Parsad, Rajender and Gupta, VK. Row-Column designs for 2^n factorial 2-colour microarray experiments for estimations of main effects and two factor interactions for orthogonal parameterization.
- Datta, Anindita*, Jaggi, Seema, Varghese, Cini and Varghese, Eldho. Some series of row-column designs with multiple units per cell.
- Farooqi, Samir*, Sanjukta, RK, Mishra, DC, Singh, DP, Rai, Anil, Chaturvedi, KK and Sharma, Naveen. Gene expression analysis and synonymous codon usage patterns in *Rhizobium etli*.
- Gautam, Y*, Sudeep, Singh, Pal and Shirur, M. On-line decision support system for mushroom cultivation.
- Gupta, AK*, Chandra, Hukum and Sud, UC. Estimation of meat production in north east hilly region.
- Gurung, Bishal*, Ghosh, Himadri and Prajneshu. Fitting exponential autoregressive nonlinear time-series model using Extended Kalman Filtering technique.
- Iquebal, MA*, Prajneshu and Sarika. Nonlinear support vector regression technique for modelling and forecasting maize crop yield.
- Islam, Shah Nawazul*, Chaturvedi, KK, Farooqi, Samir, Sabir, Naved, Sharma, Kirti, Agarwal, Hari Om, Sharma, JP, Sharma, RK, Shoran, Jag, Sharma, AK, Singh, Randhir and Gupta, RK. Expert system for the identification and control of weeds in wheat crop.
- Jaggi, Seema*, Varghese, Cini, Varghese, Eldho and Sharma, Anu. Web generation of experimental designs balanced for indirect effects of treatments.
- Jain, VK* and Gupta, AK. Harvest and post harvest losses of food grain crops.
- Kaul, Sushila. International trade in Indian agriculture and its impact on Indian economy.
- Khanduri, OP. Information system for designed experiments.
- Kumar, Amrender*, Singh, KN, Chattopadhyay, C and Vennila, S. Trend analysis of climate variables and their effects on pests of pigeonpea.
- Kumar, Anil* and Chaturvedi, Ajit. Bayesian estimation procedures for the reliability function and $P(X>Y)$ of inverse weibull distribution.
- Kumar, Prakash*, Lal, Krishan, Parsad, Rajender and Gupta, VK. Construction of balanced confounded symmetrical factorial nested row column designs.
- Kumar, Raju*, Wahi, SD and Sud, UC. Estimation of population ratio using calibration approach.
- Kumar, Suresh, Singh, DR*, Kumar, Shiv and Kumar, Anil. Estimation of farm level efficiencies in wheat cultivation under sprinkle irrigation in Rajasthan: An application of data envelopment analysis.
- Kumari, Vandita*, Agrawal, Ranjana and Kumar, Amrender. Use of ordinal logistic regression in crop yield forecasting.
- Lal, Krishan*, Parsad, Rajender, Gupta, VK and Bhar, LM. Robust designs of two-way elimination of heterogeneity with t -family of error distribution.
- Lal, SB*, Sharma, Anu, Chandra, Hukum and Rai, Anil. Web based software for survey data analysis (SSDA2).
- Mandal, BN*, Parsad, Rajender and Gupta, VK. Construction of binary incomplete block designs with specified concurrence matrix through multi-step linear integer programming approach.
- Mazumder, Chiranjit*, Jha, Girish K, Bharadwaj, Anshu and Kumari, Jyoti. Nonlinear principal component based fuzzy clustering: A case study of lentil genotypes.
- Meher, Prabina Kumar*, Sahu, Tanmaya Kumar and Rao, AR. Prediction of donor (5') splice sites based on di-nucleotide dependency difference using random forest (RF): A *de novo* approach.
- Mishra, DC*, Farooqi, Samir, Sanjukta, RK, Kumar, Sanjeev, Rai, Anil and Sharma, Naveen. Comparative study on gene classification using synonymous codon usage.
- Panwar, Sanjeev*, Singh, KN, Kumar, Anil and Sivaramane, N. Forecasting of growth rates of

- wheat yield of Uttar Pradesh through nonlinear growth models.
- Paul, AK*, Raman, Rohan and Wah, SD. The performance of linear discriminant function under both multivariate normal and non-normal situations.
- Paul, AK*, Raman, RK and Wah, SD. Empirical comparison of the performance of linear discriminant function under multivariate non-normal and normal data.
- Paul, Manju Mary*, Rai, Anil and Kumar, Sanjeev. Classification of cereal proteins related to abiotic stress based on their structural composition using support vector machine.
- Raman, Rohan Kumar*, Sud, UC, Chandra, Hukum and Gupta, VK. On calibration approach based ratio estimation with sub-sampling the nonrespondents.
- Ranganath, HK*, Prajneshu and Ghosh, Himadri. Linear regression models for symbolic interval-valued data.
- Ray, Mrinmoy*, V, Ramasubramanian, Kumar, Amrender and Ramasundaram, P. Time-series intervention modelling for forecasting cotton yield in India.
- Sadhu, Sandip Kumar*, V, Ramasubramanian, Rai, Anil and Kumar, Adarsh. Decision tree based models for classification in agricultural ergonomics.
- Sahoo, PM*, Ahmad, T, Singh, KN and Gupta, AK. Prediction of missing information in satellite images using GIS.
- Sahu, Tanmaya Kumar*, Bajetha, Garima, Rao, AR and Rai, Anil. Cattle genomic resource information system (C-GRIS): A comprehensive portal for conservation of cattle genetic resources.
- Sarika*, Iquebal, MA, Rai, Anil and Kumar, Dinesh. *In-silico* identification of salt stress genes of grape.
- Sarkar, Kader Ali*, Jaggi, Seema, Bhowmik, Arpan, Varghese, Eldho and Varghese, Cini. Series of trend resistant balanced bipartite block designs.
- Sarkar, Susheel Kumar*, Lal, Krishan and Gupta, VK. Construction of linear trend-free multi-level factorial experiments.
- Sharma, Anu*, Varghese, Cini and Jaggi, Seema. WS-PBIBD: A web solution for partially balanced incomplete block designs.
- Sharma, NK. Fertilizer response ratios for rice-rice and rice-wheat crop sequences on farmers field based on initial soil test values.
- Sharma, Richa* and Hanagal, David D. Modeling heterogeneity in diabetic retinopathy data by inverse Gaussian distribution using Bayesian approach.
- Shekhar, Shashi* and Bhar, Lalmohan. Incomplete block designs for parallel line assays.
- Shekhar, Shashi and Bhar, Lalmohan*. Incomplete block designs for asymmetric parallel line assays.
- Singh, N Okendro*, Bhar, LM, Singh, KN, Singh, N Gopimohon and Paul, AK. A method of reparameterization for aphid population growth model.
- Singh, Nishtha*, Sahu, Tanmaya Kumar, Wah, SD and Rao, AR. Epigenetic database of agriculturally important species.
- Singh, Pal* and Sudeep. E-learning solution: Management system PG School, IARI.
- Sivaramane, N*, Mathur, VC, Singh, DR and Jha, Girish. Competitiveness and dynamics of India's rice exports from India.
- Srivastava, Sudhir*, Varghese, Cini, Jaggi, Seema and Varghese, Eldho. Augmented partial diallel cross plans involving two sets of parental lines.
- V, Ramasubramanian* and Bishop, Peter C. Applications of technology forecasting methods for cotton in India.
- Varghese, Cini*, Jaggi, Seema and Sarkar, Kallol. A series of incomplete factorial row-column designs.
- Varghese, Eldho*, Jaggi, Seema and Varghese, Cini. Row-column designs balanced for neighbour effects.
- **26th National Conference on Agricultural Marketing held at Gokhale Institute of Politics and Economics, Pune during 20-22 December 2012**
 - Bhardwaj, SP. Price stability is the main agenda of agricultural price policy.
 - Praveen, KV, Kumar, Shiv, Singh, Dharam Raj, Arya*, Prawin, Chaudhary, Khyaliram and Kumar Anil. A study on economic behaviour, perception

and attitude of households towards traditional and modern food retailing formats in Kochi.

- **8th International Triennial Calcutta Symposium on Probability and Statistics, Calcutta during 27-30 December 2012**
 - Chandra, H*, Sud, UC, Chambers, R and Salvati, N. Spatial nonstationarity in small area estimation. (Invited talk).
 - Gharde, Y and Chandra, H*. Hierarchical bayes small area estimation approach for spatial data.
 - Ghosh, H*, Gurung, Bishal and Prajneshu. Modelling and forecasting of asymmetric stochastic volatility model with mean.
- **International Conference on Recent Advances in Mathematical Statistics and its Applications in Applied Sciences organized at Guwahati University, Assam during 31 December 2012 - 20 January 2013**
 - Ghosh, H. An improved fuzzy time series method of forecasting.
 - Paul, RK. Modelling and forecasting of Indian monsoon rainfall by wavelet methodology.
- **International Conference on Statistics, Science, and Society: New Challenges and Opportunities (IISA 2013), organized by International Indian Statistical Association, Chennai, India during 02-05 January 2013**
 - Chandra, H*, Chambers, R, Salvati, N and Sud, UC (2013). Spatial Nonstationarity in small area estimation. (Invited talk)
- **100th Indian Science Congress organized at Calcutta University, Kolkata during 03-07 January 2013**
 - Datta, Anindita, Jaggi, Seema, Varghese, Cini* and Varghese, Eldho. Structurally incomplete row-column designs with multiple units per cell.
 - Ghosh, H* and Prajneshu. Genetic algorithm for fitting SETARMA nonlinear time series modelling and development of out-of-sample forecasts.
 - Murali, S, Sahu, TK, Jahageerder, S, Behra, BK, Rao, AR*. In silico characterization of splice sites of zebra fish.
 - Paul, AK*, Das, S and Wahj, SD. Comparative performance of different imputation techniques against missing observations for different classification procedures.
- Rao, AR*, Dash, M, Behra, BK, Sharma, AP. Statistical and computational approaches in animal and fish genomics.
- Singh, N, Rao, AR*, Thelma, BK. Identification of genome wide SNPs associated with ulcerative colitis using machine learning approaches.
- Varghese, Cini* and Kumar, Arvind. Row-column designs for investigational products vs. control comparisons in veterinary trials.
- Varghese, Eldho. MERC designs for diallel cross experiments with specific combining abilities [Paper presented in the Young Scientist Award programme in the section of Mathematical Sciences (Including Statistics)]
- **International Symposium on Genomics in Aquaculture at Central Institute of Freshwater Aquaculture, Bhubaneswar during 22-23 January 2013**
 - Iquebal, MA, Sarika and Kumar, Dinesh*. Next generation sequencing and its challenges. (Lead paper)
- **10th Symposium of Biotechnological Approach for Plant Protection: Constraints and Opportunities at Goa during 27-29 January 2013**
 - Islam, SN. Expert System: An IT based approach in IPM (Invited talk)
- **International Conference on Reliability, Infocom Technologies and Optimization (ICRITO 2013) held at Amity University, Noida, UP (India) during 29-31 January 2013**
 - Chaturvedi, KK*, Singh, VB and Khatri, SK. A study of bug prediction using Mozilla.
- **International Conference on Bio-resource and Stress Management organized at Science City, Kolkata during 06-09 February 2013**
 - Mishra, Dwijesh. Identification of co-regulated genes of chick-pea under abiotic stress.
- **15th Annual Conference on Statistics and Informatics in Agricultural Research of Society of Statistics, Computer and Applications organized at Banasthali Vidyapith, Banasthali during 24-26 February 2013**
 - Chandra, H*, Gharde, Y and Jain, VK. Small area estimation using estimated population level auxiliary data. (Invited talk).



- Dasgupta, Pratyush, Bhar, Lalmohan* and Gupta, VK- Robustness of BIB designs for multi-response experiments against the loss of observations. (Invited talk)
 - Dash, Sukant. Efficient block designs for mixed level factorial micro-array experiments based on baseline parameterization.
 - Parsad, Rajender* and Gupta, VK. Agricultural statistics in the welfare of the society. (Invited talk).
 - Paul, RK. Determination of trend in rainfall for different agro-climatic zones in India using wavelet techniques.
 - Sadhu, Sandip Kumar and V, Ramasubramanian*. Decision tree based models for classification in agricultural ergonomics.
 - Sarkar, Susheel Kumar*, Lal, Krishan and Gupta, VK. Construction of cost efficient multi-level factorial experiments.
 - Sud, UC*, Chandra, H and Gupta, VK. Calibration approach based regression type estimator for inverse relationship between study and auxiliary variable. (Invited talk).
 - Varghese, Cini*, Jaggi, Seema and Varghese, Eldho. A series of neighbour balanced polycross designs.
 - **International workshop on Data Analytics and Applications organized by Goa Campus of BIT Pilani during 26 February- 01 March 2013**
 - Rai, Anil. Agricultural bioinformatics and computational biology.(invited key speaker)
 - **7th National Conference on Computing for Nation Development – INDIACom organized by Bharti Vidyapeeth's Institute of Computer Applications and Management, New Delhi during 07-08 March 2013**
 - Dahiya, Shashi* and Yadav, Ruchi. Web based system for crop disease identification.
 - **National Symposium on Biotechnology: Present Status & Future Prospects held at Deen Bandhu Chhoturam University of Science & Technology (Haryana State Government University) on 16 March 2013**
 - Kumar, Dinesh. NGS Data analysis and its challenges. (Invited lead paper)
 - **4th Annual review Meeting of FASAL at ANGRAU, Hyderabad during 18-19 March 2013**
 - Agrawal, Ranjana. Statistical techniques for crop yield forecasting-IASRI approaches (Invited talk)
 - **National Seminar on Applied Statistics at Bayesian and Interdisciplinary Research Unit, ISI Kolkata on 22 March 2013**
 - Parsad, Rajender* and Gupta, VK. Application of designs for factorial experiments in national agricultural research system. (Invited talk)
 - **NAIP Component-I Workshop organized by NAARM Hyderabad during 22-23 March 2013**
 - Rai, Anil. Establishment of National Agricultural Bioinformatics Grid in ICAR.
- INVITED LECTURES/ SEMINAR TALKS DELIVERED**
- Dr. UC Sud**
- A lecture on Agriculture statistics for ISS probationers at National Academy of Statistical Administration (NASA), Greater Noida, UP on 21 June 2012.
 - A lecture on Agriculture in India and emerging Techniques for generation of agriculture statistics under training programme for ISS probationers at NASA, Greater Noida, UP on 02 July 2012.
 - A lecture on Agriculture in India and emerging techniques for generation of agriculture statistics under training programme on Agriculture Statistics including animal husbandry and horticulture, crop area estimation and use of GIS technology for the participants from SAARC Member States during 27-31 August 2012 at NASA, MOS&PI, Govt. of India, Greater Noida, UP.
 - A lecture on Small area estimation procedure and its uses in agriculture during training programme for the participants from Madhya Pradesh organized by NASA, Greater Noida, UP during 10-14 September 2012.
 - Two lectures i) Statistic, estimators (Least Square, Maximum Likelihood and BLUE), ii) properties of estimators with introduction to ratio and regression estimators during training programme on Basic Statistics, Sampling Techniques and Local Level Planning organized by NASA, Greater Noida, UP, for the participants from CSO, Sri Lanka during 17-21 September 2012.

- Two lectures on Small area estimation procedure and its uses in Agriculture Statistics under training programme organized by NASA, Greater Noida, UP, for the participants from DES Jammu & Kashmir during 01-12 October 2012.

Dr. Prajneshu

- Invited talk on Non-linear statistical models and their applications at JNKVV, Jabalpur on 28 December 2012.

Dr. Rajender Parsad

- A lecture on SAS: Statistical procedures under training programme on Field Survey, Data Acquisition and Analysis held at NCAP New Delhi during 21-27 July 201.
- A lecture on SAS for statistical procedures under CAFT Training programme on Agricultural Research Planning and Impact Assessment organized at Division of Agricultural Economics, IARI, New Delhi during 17 August - 06 September 2012.
- Two lectures on SAS: An overview to the participants of the training programme on Statistical Models for Forecasting in Agriculture organized at IARI, New Delhi under the aegis of CAFT during 11 September – 01 October 2012 .
- Two lectures on Design resources server and Indian NARS statistical computing portal through WebEx session under training programme on Analysis of Experimental Data Using SAS organized at NAARM, Hyderabad under the aegis of NAIP Consortium on Strengthening Statistical Computing for NARS during 02-08 November 2012.
- Two lectures on Design resources server and Indian NARS statistical portal during training programme on Biometrical Analysis Using SAS organized under the NAIP Consortium Strengthening Statistical Computing for NARS at IGKV, Raipur on 01 February 2013.
- Nine lectures i) SAS: An overview; ii) Tests of significance using SAS; iii) Correlation and regression analysis using SAS; (iv) Analysis of experimental data using SAS; (v) Design resources server; vi) Indian NARS statistical computing portal; vii) Mixed models using SAS; viii) Multivariate analysis using SAS and ix) Diagnostics and remedial measures under training programme on Data Analysis using SAS organized by IASRI under NAIP

Consortium Strengthening Statistical Computing for NARS at Rajmata Vijayaraja Scindia Krishi Vishwa Vidyalaya (RVSKVV), Gwalior during 18-23 February 2013.

- Three lectures i) Strengthening statistical computing for NARS, ii) Genesis, achievements and impact; Indian NARS statistical computing portal; Design resources server and iii) SAS: A brief overview under Sensitization programme on Statistical Computing for NARS organized by IISR, Lucknow on 28 March 2013.

Dr. Anil Rai

- A lecture on Genotype imputation under training program on Bioinformatics for Conservation and Improvement of Animal Genetic Resources during 18-28 February 2013 at NBAGR Karnal.

Dr. KK Tyagi

- A lecture on Sampling methods and sequential sampling plans relevant with RCT under workshop on Biostatistical Aspects of Randomized Clinical Trials (RCT) and Medical Ethics, organized at Govt. Medical College Hospital, Chandigarh on 21 September 2012.
- A lecture on Randomized response techniques under workshop on Randomised Response Techniques at Govt. Medical Hospital College, Chandigarh on 20 October 2012.

Dr. Krishan Lal

- Eight lectures i) Incomplete block designs ii) Factorial experiments, iii) Analysis of covariance, iv) Combined analysis of data, v) Response surface designs, vi) Experiments with mixtures, vii) Analysis of repeated measures and viii) Principal component analysis during training on Analysis of Design of Experiments using SAS during 19-24 November 2012 organized by Department of Agricultural Statistics and Social Science, College of Agriculture, Indira Gandhi Agricultural University, Raipur.
- Eight lectures i) Design resources server, ii) CRD, iii) RCBD, iv) LSD, v) BIB designs, vi) Factorial experiments including confounding, vii) Split and strip plot design and viii) Combined analysis of data under training programme during 18-23 February 2013 on Data Analysis for Water Management Research using SAS under the NAIP Consortium Strengthening Statistical Computing for NARS at DWM, Bhubaneswar.

Dr. Seema Jaggi

- Four Lectures (i) SPSS: An overview, (ii) Frequency Distribution and descriptive statistics using SPSS, (iii) Correlation and regression and (iv) Testing of hypothesis and ANOVA under training course on Data Processing and Analysis organized by Council for Social Development, New Delhi during 21-26 May 2012.
- Four lectures i) Correlation and regression analysis, ii) SPSS: An overview, iii) Testing of hypothesis and iv) ANOVA under training programme on Research Methodology for Social Sciences organized by Council for Social Development, New Delhi during 03-15 September 2012.
- Two lectures on SAS Enterprise Guide for analysis of experimental data under NAIP Consortium Strengthening Statistical Computing for NARS at Rajmata Vijayaraja Scindia Krishi Vishwa Vidyalaya (RVSKVV), Gwalior during 18-23 February 2013.

Dr. Lalmohan Bhar

- Three lectures i) Regression diagnostics and remedial measures, ii) Non-linear models, iii) Probit analysis and Analysis of experimental data under NAIP Consortium Strengthening Statistical Computing for NARS at Rajmata Vijayaraja Scindia Krishi Vishwa Vidyalaya (RVSKVV), Gwalior during 18-23 February 2013.

Dr. AR Rao

- Three lectures i) PCA, ii) Factor analysis and iii) Practicals on PCA & FA under training course on data processing and analysis organized by Council for Social Development, New Delhi during 21-26 May 2012.
- A lecture on R-Software: Usefulness in agricultural research under Centre for Advanced Faculty Training (CAFT) in Agricultural Economics on 23 August 2012 at Economics Division, IARI, New Delhi.
- A lecture on Structure and characterization of gene coding regions in the workshop-cum-training on Bioinformatics approaches to discover new crop genes on 26 September 2012 at NBPGR, New Delhi.
- Three lectures i) PCA, ii) Factor analysis and iii) Practicals on PCA & FA using SPSS in a training programme on Data processing and analysis, organized by Council for Social Development during 07-12 January 2013.

- Six lectures i) PCA, ii) Factor analysis, iii) Cluster analysis, iv) MANGYA, v) Stability and vi) AMMI models under training programme on Biometrical Analysis Using SAS organised during 29 January - 05 February 2013 at Indira Gandhi Agricultural University, Raipur.

Dr. Dinesh Kumar

- A lecture on DNA signature of germplasm by computational approach under summer school on phenomic and genomic tools for analysis of livestock genomes during 14 -23 June 2012 held at NBAGR, Karnal.
- A lecture on Applications of bioinformatics tools on bio-resource management at Institute of Bioresources and Sustainable Development (IBSD) (DBT Institute), Imphal, Manipur on 06 September 2012.
- Three lectures i) Analytical tools in functional and comparative genomics in fisheries domain ii) Bioinformatics tools for genome annotations and iii) Computational approach for germplasm identification at subspecies level in fishes using STR and SNP markers followed by practical on demo dataset of ten experiments under Subject-Matter training under the NAIP funded project Establishment of National Agricultural Bioinformatics Grid (NABG) held at NBFGR, Lucknow during 27 November-07 December 2012.
- Two lectures i) Microbial genome annotation and ii) Computational approach for microbial identification using DNA markers under the NAIP funded project Establishment of National Agricultural Bioinformatics Grid (NABG) on Bioinformatics: Methods, Tasks and Applications in Microbial Research held at National Bureau of Agriculturally Important Microorganism (NBAIM), Mau during 04-15 December 2012.
- A lecture on Bioinformatics tools for microbial identification under National Training Programme: Polyphasic Microbial Identification Methods and Application organized at NBAIM, Mau, UP during 05-14 March 2013.
- Two lectures i) Domestic animal genomics and Bioinformatics: Global status vs Indian scenario and ii) Bioinformatics based domestic animal germplasm piracy without movement of germplasm: Case studies under CAFT programme on Molecular genetic data generation, analysis and utilization in animal breeding organized at National Dairy

Research Institute, Karnal during 05-25 March 2013.

- Three lectures i) Genome annotation in Prokaryotes and Eukaryotes, ii) Intellectual property right and germplasm management: Indian case studies and iii) Microarray probe designing and data analysis under DBT -National Training on Functional genomic analysis for livestock improvement at PDC, Meerut during 22 January-04 February 2013.
- Two lectures i) Application of bioinformatics tools in agricultural productivity and ii) Intellectual property rights & Domestic animal germplasm: case studies under training workshop on Bioinformatics: Applications in Agricultural & Medical Sciences held at Centre for Bioinformatics, School of Biotechnology, BHU, Varanasi during 09-11 February 2013.
- A talk on Computational approach for crop and domestic animal improvement: Global status and challenges for India at State Agricultural University SKUAST, Jammu on 11 March 2013.

Dr. Cini Varghese

- Three lectures (i) frequency distribution and graphical presentation, (ii) Descriptive statistics and (iii) Practical on correlation and regression using SPSS and Practical on testing of hypotheses and ANOVA using SPSS under training course on Data Processing and Analysis organized by Council for Social Development, New Delhi during 21-26 May 2012.
- Three lectures (i) Introduction to basic statistics; (ii) Non-parametric methods and (iii) Practical: Statistical analysis using SPSS under training programme on Research Methodology for Social Sciences organized by Council for Social Development, New Delhi during 03-15 September 2012.
- Three lectures i) Tests of significance, ii) Practical on tests of significance and iii) Non-parametric tests and Practical on non-parametric tests under training course on Data Processing and Analysis organized at Council for Social Development, New Delhi during 07-12 January 2013.

Dr. Hukum Chandra

- Two lectures i) Overview of R software and practical exercise and ii) Survey data analysis using R software under training programme on Agriculture

statistics including animal husbandry and horticulture, crop area estimation and use of GIS technology for the participants from SAARC Member States during 27-31 August 2012, at National Academy of Statistical Administration, M/o S&PI, Govt of India, Greater Noida, UP.

Dr. Ramasubramanian V

- A lecture on Technology forecasting models in agriculture under CAFT training programme on Agricultural Research Planning and Impact Assessment organized at Division of Agricultural Economics, IARI, New Delhi during 17 August - 06 September 2012.
- Lectures on Correlations, practical on correlations using SPSS, regression: univariate and multivariate and practical on regression using SPSS under training course on Data Processing and Analysis organized at Council for Social Development, New Delhi during 07-12 January 2013.
- Six lectures i) Simple and multiple linear regression modeling, diagnostics & remedial measures, ii) Forecasting using weather indices based regression models, iii) Fitting non-linear models – Gompertz, Logistic and monomolecular, iv) Time series analysis and modelling - Exponential smoothing, ARIMA, Intervention and ARCH/GARCH models, v) Logistic regression and logit models and vi) Markov chain modeling for crop forecasting under training programme on Data Analysis Using SAS during 14-20 January 2013 at MPUAT, Udaipur.
- Three lectures i) Cluster analysis, ii) Canonical correlation and iii) Multi-dimensional scaling under training programme on Survey Design and Data Analysis using SAS in Social Sciences at NAARM, Hyderabad held during 28 January-06 February 2013.
- Two lectures i) Multi-dimensional scaling and ii) Logistic regression for classification and prediction under training programme on SAS for Data Reduction and Multivariate Analysis at CIFE, Mumbai held during 11-16 February 2013.
- Five lectures i) Time series analysis using SAS (Exponential smoothing, ARIMA, etc.), ii) Hands on time series analysis, iii) Fitting non-linear models using SAS, iv) Multidimensional scaling using SAS and v) Forecasting using weather indices based regression models through SAS under NAIP Consortium Strengthening Statistical Computing for

NARS at Rajmata Vijayaraja Scindia Krishi Vishwa Vidyalaya (RVSKVV), Gwalior during 18-23 February 2013.

- A lecture on Technology forecasting techniques with applications in agriculture: Retrospect and prospects under national workshop on Foresight and Future Pathways of Agricultural Research through youth in India held at NAS Complex, New Delhi during 01-02 March 2013.

Dr. Prachi Misra Sahoo

- A lecture on Geostatistics and its applications under national workshop on geospatial technologies and applications held during 30-31 May 2012 at Manav Rachna International University, Faridabad.
- A lecture on Spatial data modeling and its applications during training programme on Geospatial Technology for the university and college faculty held during 22 May - 11 June 2012 at the Department of Geography, Jamia Millia Islamia, New Delhi sponsored by NRDMS of DST.

Dr. Alka Arora

- Two lectures Hyper Text Markup Language (HTML) and Microsoft Word as HTML editor in the CAFT training program on Emerging Paradigms of Competencies for Extension Professionals in Context of Changing Agricultural Scenario during 03-23 January 2013 at IARI.

Md. Samir Farooqi

- A lecture on Data management and statistical procedures using SAS EG under the training programme on Data Analysis Using SAS during 04-09 March 2013 at SKRAU, Bikaner.
- Five lectures on Design resources server, Indian NARS Statistical Computing Portal Analysis, running of macros and data management and statistical procedures using SAS EG, under the training program held at National Bureau of Agriculturally Important Microbes (NBAIM), Mau Nath Bhanjan, Uttar Pradesh during 22-24 November 2012.

Dr. Wasi Alam

- A lecture on Simulation modelling and design of experiments under training on Recent advances in micro-irrigation and fertigation at Center for Protected Cultivation Technology (CPCT), IARI, New Delhi during 05-25 November 2012.

Dr. Amrit Kumar Paul

- Four lectures i) SAS for biometrical analysis, ii) SAS for inbreeding analysis, iii) Diallel analysis using SAS and iv) SAS macros for biometrical study under training programme on Biometrical Analysis using SAS at IGKVV, Raipur on 28 January 2013.
- Three lectures i) Application of SAS for breeding data analysis, ii) Diallel analysis using SAS and iii) Running of genetics SAS macro under NAIP Consortium Strengthening Statistical Computing for NARS at Rajmata Vijayaraja Scindia Krishi Vishwa Vidyalaya (RVSKVV), Gwalior during 18-23 February 2013.

Dr. Dwijesh Chandra Mishra

- A lecture on Statistical data mining using MATLAB under workshop on statistical data mining using matlab at Maharaja Agrasen Institute of Technology, New Delhi during 26-27 July 2012.
- Seven lectures i) Exploratory data analysis using SAS, ii) Application of SAS software in basic statistical analysis, iii) Correlation and regression analysis, iv) Multivariate analysis, v) Analysis of the data of designed experiments, vi) Microarray data analysis using JMP genomics and vii) Cluster analysis under the training program held at National Bureau of Agriculturally Important Microbes (NBAIM), Mau Nath Bhanjan, Uttar Pradesh during 22-24 November 2012.

Dr. Sudeep

- A lecture on Designing expert system, Content creation (Web designing, Multimedia Authoring Tools) in the CAFT training program on Emerging Paradigms of Competencies for Extension Professionals in Context of Changing Agricultural Scenario during 03-23 January 2013 at IARI.

Dr. Tauqueer Ahmad

- A lecture on Crop area estimation using GIS and remote sensing technology under training programme on Agriculture statistics including animal husbandry and horticulture, crop area estimation and use of GIS technology for the participants from SAARC Member States during 27-31 August 2012, at National Academy of Statistical Administration, M/o S&PI, Govt of India, Greater Noida, UP.
- A lecture on Overview of geographic information system under training programme on Research Methodology for Social Sciences organized by

Council for Social Development, New Delhi during 03-15 September 2012.

Sh. SN Islam

- Three lectures i) Expert system on wheat and ii) Expert system on seed spices and iii) e-Platform for seed spice growers under farmers training programme at NRCSS, Ajmer on 30 October 2012 and at Krishihig Vigyan Kendra, Tabiji, Ajmer under Rajasthan Agricultural University on 31 October 2012.
- A lecture on Expert system technology for irrigation management during a Winter School Recent Advances in Micro Irrigation and Fertigation at CPCT, New Delhi on 09 November 2012.

Smt. Anu Sharma

- A lecture on Overview of data mining under workshop on statistical data mining using matlab at Maharaja Agrasen Institute of Technology, New Delhi during 26-27 July 2012.

Smt. Anshu Bharadwaj

- Two lectures i) Geoinformatics in precision agriculture: Statistical aspect and ii) Spatial data mining under training on Geospatial Technologies and its Applications at HPKV, Palampur during 30 June-02 July 2012.

Dr. Eldho Varghese

- Three lectures i) Non-parametric tests, ii) Practical on non-parametric tests using SPSS and iii) Logistic regression and practical on logistic regression using SPSS under training course on data processing and analysis organized by Council for Social Development, New Delhi during 21-26 May 2012.

Sh. Sanjeev Kumar

- Three lectures i) Classification techniques, ii) SVM and SVM using MATLAB and iii) R under workshop on statistical data mining using matlab at Maharaja Agrasen Institute of Technology, New Delhi during 26-27 July 2012.

Sh. SB Lal

- A lecture on Parallel computing and workflows/pipelines in bioinformatics under a workshop on Bioinformatics Tool and Application in Agriculture organized by Unit of Simulation and Informatics, IARI, New Delhi during 11-13 March 2013.

PARTICIPATION

Conferences / Workshops / Seminars / Symposia/ Trainings etc.

- Symposium on Agricultural biotechnology Regulation, Trade, and Co-existence 2012 - BIGMAP which was held at Gateway Hotel and Conference Centre, Ames, IA, USA on 14 April 2012. (Dr. AK Paul)
- 5th World Information Technology Forum (WITFOR) 2012 i.e. the International Federation for Information Processing (IFIP) flagship conference on ICT for Sustainable Human Development organized in partnership with the Department of Electronics and Information Technology, Ministry of Communications and Information Technology, Govt. of India at Vigyan Bhawan, New Delhi during 16-18 April 2012. (Dr. KN Singh, Dr. Tauqueer Ahmad, Dr. Prachi Misra Sahoo, Dr. Cini Varghese, Dr. Alka Arora, Ms. Shashi Dahiya, Ms. Anshu Bharadwaj, Sh. Pal Singh, Sh. SN Islam, Sh. Soumen Pal, Dr. AR Rao, Sh. SB Lal, Smt. Anu Sharma, Sh. Sanjeev Kumar, Dr. DC Mishra, Md. Samir Farooqi and Sh. KK Chaturvedi)
- National Conference on Cooperatives organised at NASC on 15 May 2012. (Dr. Sushila Kaul)
- International Conference on New Statistical Methods for Next Generation Sequencing Data Analysis on 11 May 2012 at Iowa State University, Howe Hall, Alliant Energy Lee Liu Auditorium. (Dr. AK Paul)
- National Conference on Cooperatives' at NASC, New Delhi on 15 May 2012. (Dr. Sushila Kaul)
- Policy Dialogue on Building Climate Resilient Agriculture in India, organized jointly by the International Crop Research Institute for Semi-Arid Tropics (ICRISAT) and the Indian Council of Agricultural Research (ICAR) on 22 May 2012 in National Agricultural Science Centre (NASC), Pusa, New Delhi. (Dr. DR Singh)
- Ion Torrent™ International Workshop hosted by the Genomic Technologies Facility, Iowa State University, Ames, USA on 22 May 2012. (Dr. AK Paul)
- Workshop on IPv6 Essentials, Implementation and Security organized at CERT-In, Electronics Niketan, CGO Complex, New Delhi on 11 June 2012. (Md. Samir Farooqi and Smt. Anu Sharma)
- Annual Review Workshop of NICRA at CRIDA, Hyderabad during 12-14 June 2012. (Dr. RK Paul)

- SAS Installation Workshop at NAARM, Hyderabad on 27 June 2012 and at CIFE, Mumbai on 30 June 2012. (Dr. AK Paul)
- Working Group for the Construction of Index Numbers of Area, Production and Yield of Crops on 03 July 2012 at Krishi Bhawan, New Delhi. (Dr. VK Bhatia)
- National Workshop on Standardization of Methodology for Estimating Cost of Milk Production in India at NDRI, Karnal on 06 July 2012. (Dr. KK Tyagi and Dr. Hukum Chandra)
- 1st International Conference on Mathematics and Mathematical Sciences, Molecular Marg, Lodhi Road, New Delhi during 07-08 July 2012. (Dr. Anil Kumar)
- Training Programme on Knowledge Management and Knowledge Sharing in Organisation held at IIPA, New Delhi during 23-29 July 2012. (Dr. Prajneshu)
- Valedictory function of the training programme on Field Survey, Electronic Compilation and Analysis of Data at NCAP, New Delhi on 28 July 2012. (Dr. VK Bhatia)
- Authors Workshop organized by DULS, University of Delhi and Springer Private Ltd. on 23 August 2012 at Conference Centre, University of Delhi, Delhi. (Sh. KK Chaturvedi)
- 51st All India Wheat and Barley's Worker's Meet at Jaipur during 23-27 August 2012. (Sh. SN Islam)
- 6th CSI-IEEE International Conference on Software Engineering (CONSEG-2012) during 05-07 September 2012 held at DAVV Indore, MP (India). (Sh. KK Chaturvedi)
- National workshop on Improvement of Agricultural Statistics organized during 19-20 September 2012 by Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India. (Dr. UC Sud, Dr. KK Tyagi, Dr. Tauqueer Ahmad and Dr. Hukum Chandra)
- International Conference on Advances in Interdisciplinary Statistics and Combinatorics at UNCG, USA during 05-07 October, 2012. (Dr. Prajneshu)
- Workshop on National Data Sharing and Accessibility Policy on 05 October 2012 organized by National Informatics Centre (NIC) at CGO Complex, New Delhi. (Dr. VK Bhatia, Dr. Seema Jaggi and Dr. Alka Arora)
- 4th Organisation for Economic Cooperation and Development (OECD) World Forum during 16-19 October 2012 at New Delhi. (Dr. Hukum Chandra)
- Workshop on Wireless Security organized by the Department of Electronics and Information Technology on 17 October 2012 at Electronics Niketan, CGO Complex, New Delhi. (Sh. SN Islam, Sh. Virendra Kumar and Sh. Sunil Bhatia)
- XXX Workshop of AICRP on Integrated Farming Systems during 16-19 November 2012 at ICAR Research Complex for Goa. (Dr. Anil Kumar and Sh. NK Sharma)
- 26th Workshop on Developing Winning Research Proposals organized by NAIP at NAARM, Hyderabad during 22-23 November 2012. (Dr. Dinesh Kumar, Dr. Anil Rai and Sh. Sanjeev Kumar)
- 6th International Conference on Quality, Reliability, Infocomm Technology and Industrial Technology Management (ICQRITIM 2012) during 26-28 November 2012 at Conference Centre, University of Delhi, Delhi. (Sh. KK Chaturvedi)
- 3rd International Agronomy Congress on Agricultural Diversification, Climate Change Management and Livelihoods organized at IARI, New Delhi during 26-30 November 2012. (Sh. SN Islam)
- National Symposium on Space Technology for Food & Environment Security & Annual Convention of Indian Society of Remote Sensing & Indian Society of Geomatics at IARI, New Delhi during 05-07 December, 2012. (Dr. Prachi Misra Sahoo)
- International Conference on Reviving Growth organized by Ministry of Finance (GoI), CII and NIPFP under Delhi Economics Conclave-2012 held at Hotel Taj Palace, New Delhi during 14-15 December 2012. (Dr. DR Singh and Dr. Prawin Arya)
- 26th Annual Conference of Indian Society of Agricultural Marketing held at Pune during 20-22 December 2012. (Dr. SP Bharadwaj)
- International Conference on Big Data Analytics (BDA 2012) during 24-26 December 2012 organized by Department of Computer Science, University of Delhi (India) and University of Aizu (Japan) held at India International Centre, New Delhi (India). (Sh. KK Chaturvedi)
- Workshop on Combinatorial Mathematics with Statistical Applications in Health and Related Sciences at Guwahati University, Guwahati, Assam, India on 30 December 2012. (Dr. RK Paul)

- **International Conference on Statistics, Science, and Society: New Challenges and Opportunities (IISA 2013), organized by International Indian Statistical Association, Chennai, India during 02-05 January 2013**
 - Dr. Hukum Chandra as Convener and Chaired two sessions (i) session on Sample and Census, and (ii) session on Recent Advances in Sample Surveys
 - Dr. UC Sud organized a Session on Recent Advances in Sample Surveys
- National Workshop on Statistics in Health Research at TERI, New Delhi supported by ICMR on 04 January 2013. (Dr. Prachi Misra Sahoo)
- National Workshop on Museum Evaluation & Visitor Research organized by National Science Centre, Delhi during 17-19 January 2013. (Dr. Sushila Kaul)
- International Conference on Reliability, Infocom Technologies and Optimization (ICRITO 2013) during 29-31 January 2013 held at Amity University, Noida, UP. (Sh. KK Chaturvedi)
- International Conference on Bio-resource and Stress Management during 06-09 February 2013 organized at Science City, Kolkata (Dr. Dwijesh Chandra Mishra)
- Brainstorming Workshop on Methodologies to Assess Impact of Capacity Building under NAIP jointly organized by International Food Policy Research Institute and NAIP on 21 February 2013 at NASC Complex, Pusa, New Delhi (Dr. AR Rao also acted as a Panelist in the Technical Session-II on Experience sharing on impact of capacity building)
- 15th Annual Conference of the Society of Statistics and Computer Applications during 24-26 February 2013 at Apaji Institute of Mathematics & Applied Computer Technology, Banasthali Vidyapith, Banasthali, Jaipur, Rajasthan. (Dr. UC Sud, Dr. Rajender Parsad, Dr. LM Bhar, Dr. Hukum Chandra, Dr. Cini Varghese, Dr. Susheel Kumar Sarkar and Dr. Sukant Dash)
- Workshop on the Cost of Cultivation Study at Management Study Centre, Harish Chandra Mathur, Regional Public Administration Institute (HRM RIPA), Jawahar Lal Nehru Marg, Jaipur (Rajasthan) on 26 February 2013. (Dr. UC Sud)
- International workshop on Data Analytics and

Applications organized by Goa Campus of BITS Pilani during 26 February-01 March 2013 (Sh. SB Lal)

- Workshop on Information Technology in Agriculture and Food-A strategy formulation meeting during 15-16 March 2013 at NASC Complex, New Delhi. (Dr. Anil Rai)
- National Seminar on Applied Statistics on 22 March 2013 at Bayesian and Interdisciplinary Research Unit, ISI Kolkata. (Dr. Rajender Parsad)

Krishi Vigyan Mela- 2013

Institute participated in the Krishi Vigyan Mela 2013 held at IARI, New Delhi during 06-08 March 2013. Maize Agridaksh, Expert System on Wheat Crop Management, Expert System for Mushroom Crop, Expert System on Seed Spices and Design Resources Server were demonstrated to visitors, researchers and farmers. Posters on several other research achievements such as Strengthening of Statistical Computing for NARS, Management System: PG School IARI, eLearning resource for teaching and training agricultural women, Center for Agricultural Bioinformatics, Modelling the crop yield under agroforestry system, Impact assessment of



agroforestry system on the yield of associated barley and gram crops etc., were exhibited at the stall and the visitors were given leaflets and encouraged to use the expert systems developed.

Trainings

- Training on Practical approach on Networking during 11-15 April 2012 at IIT, Kanpur. (Sh. SN Islam)

- All India Training of Trainers on data collection for 19th Livestock Census, 2012 organized by Animal Husbandry Statistics Division of Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, GOI at IASRI, New Delhi on 12 June 2012. (Dr. UC Sud, Dr. KK Tyagi, Dr. AK Gupta and Sh. VK Jain)
 - Management Development Programme in Agricultural Research at NAARM, Hyderabad during 02-07 July 2012. (Dr. UC Sud)
 - Training/meeting/ workshop on Harvest and Post Harvest Losses during 03-04 September 2012 at MPUAS, Jaipur. (Dr. Anil Rai)
 - Training programme on Statistical Model for Forecasting in Agriculture offered by IASRI under CAFT from 11 September-01 October 2012. (Dr. Eldho Varghese)
 - All India Training of Trainers (AITOT) for the 70th round of NSS, to discuss the sampling design, schedules of enquiry and procedures for data collection, etc. at Indian Institute of Mass Communication, Aruna Asaf Ali Marg, New JNU Campus, New Delhi during 27-29 September 2012. (Dr. UC Sud)
 - Management Development Programme on Leadership Development (a Pre-RMP Programme) training programme organized by NAARM, Hyderabad during 08-19 October 2012. (Dr. Rajender Parsad and Dr. KN Singh)
 - Short term course on Soft Computing Techniques Applications during 05-09 November 2012 at GB Pant University of Agriculture and Technology by National Institute of Technical Teachers' Training and Research (NITTTR), Chandigarh. (Dr. MA Iquebal)
 - Training course on Field Trial & QTL Analysis using R & R/QTL at ICRISAT Hyderabad during 03-06 December 2012. (Dr. Susheel Kumar Sarkar)
 - National training on Project formulation, risk assessment, scientific report writing and presentations (NAIP funded) in the Division of Agricultural Engineering, Indian Agricultural Research Institute during 11-15 December 2012. (Dr. Ramasubramanian V, and Sh. Arpan Bhowmik)
 - Professional Attachment training at NBAIM, Mau, UP as a part of 94th FOCARS Training during 22 February - 22 May 2012 (Sh. Sudhir Srivastava).
 - Professional Attachment training under Dr. RN Sahoo, Senior Scientist, Division of Agricultural Physics, IARI, New Delhi as a part of 96th FOCARS training during 01 January-31 March 2013. (Sh. Ankur Biswas)
 - Professional Attachment training under Prof. Alope Dey at Indian Statistical Institute (Delhi Centre) as a part of 96th FOCARS training during 01 January - 31 March 2013 (Sh. Arpan Bhowmik)
 - National Workshop on Museum Evaluation & Visitor Research organized by National Science Centre, Delhi during 17-19 January 2013. (Dr. Sushila Kaul)
 - Training programme on Hyper Spectral Remote Sensing for Agriculture (HYPERAGRI-2013) sponsored by Department of Science and Technology (DST), Govt. of India in the Division of Agricultural Physics, IARI, New Delhi during 18-27 February 2013. (Sh. Ankur Biswas)
 - Training program on Hyperspectral Remote Sensing and Applications in Water Resources during 18-23 March 2013 in Agricultural and Food Engineering Department, Indian Institute of Technology, Kharagpur. (Dr. Prachi Misra Sahoo)
- Visit Abroad**
- Dr. VK Gupta**
- UK to attend the meeting of the CRP 1.1 Dryland Systems - Integrated Agricultural Production Systems for the Poor and Vulnerable Dry Areas of the CGIAR at University of Reading, UK held during 26-28 November 2012.
- Dr. VK Bhatia**
- EBI, London and SIB Switzerland for studying the infrastructural facilities, exploring the possibility of collaboration and capacity building as a member of the team of five scientists constituted by ICAR during 17-22 June 2012.
 - Bangkok, Thailand to attend meetings of the Steering Group of Agricultural Statistics held during 24-25 May 2012 and 18-20 July 2012.
- Dr. UC Sud**
- Thailand to attend Regional Workshop on Sampling for Agricultural Censuses and Surveys in Bangkok, Thailand during 13-18 May 2012.
 - Bangladesh for the Consultancy on Harmonization and Dissemination of Unified Agricultural Production

Statistics in Bangladesh during 16-23 October 2012 and during 18-20 December 2012.

Dr. Rajender Parsad

- Japan to attend Session on Design of Experiments of 2nd Institute of Mathematical Statistics Asia Pacific RIM Meeting and presented an invited talk on Efficient Row-Column Designs for 2-colour single factor microarray experiments at Tsukuba, Japan during 02-04 July 2012.

Dr. Prajneshu

- Pakistan to participate in 13th International Pure Mathematics Conference 2012 and delivered an invited talk entitled Some Parametric Nonlinear Time-Series Models and their Applications in Agriculture at Islamabad, Pakistan during 02-03 September 2012.
- USA to participate in the International Conference on Advances in Interdisciplinary Statistics and Combinatorics held at UNCG, USA during 05-07 October 2012.

Dr. Anil Rai

- EBI, London and SIB Switzerland for studying the infrastructural facilities, exploring the possibility of collaboration and capacity building as a member of the team of five scientists constituted by ICAR during 17-23 June 2012.

Dr. Hukum Chandra

- Colombia to attend the 22nd Colombian Symposium in Statistics at Bucaramanga, Colombia during 17-21 July 2012. He delivered an invited talk on Applications of small area estimation.

Dr. AK Paul

- USA for three months NAIP HRD training in the area of Crop Bioinformatics (Comparative genomics in soybean's pathogens) in Agronomy Division of Iowa State University, USA during 08 March-07 June 2012.

Dr. Prawin Arya

- USA to attend three months international training under NAIP on Policy Analysis: Sub area : Modeling for Land Use Planning (Social Sciences) at Division of Agricultural and Biosystems Engineering, Iowa State University of Science and Technology, Davidson Hall, Ames, USA during 15 June-12 September 2012.

Sh. Sanjeev Kumar

- USA to attend training programme in the area of Bioinformatics and Comparative Genomics at Iowa State University, Ames, Iowa, USA during 14 December 2012-07 March 2013.





Conferences, Workshops, Meetings, Seminars and Annual Day Organized

CONFERENCES

- **20th Annual Conference and Silver Jubilee of the Agricultural Economics Research Association (AERA) India** on the theme “Agricultural Inputs and Services Delivery System for Accelerating Growth and Improving Farm Income” held at Division of Agricultural Economics, Indian Agricultural Research Institute, New Delhi organized by IARI, NCAP and IASRI during 09-11 October 2012. Dr. VK Bhatia was the Co-chairman of Technical Session II: Agricultural Research, Extension and Input Services and Dr. Seema Jaggi was the panelist in the Planery Session II on Strengthening Agricultural Policy Research.
- **International Conference on Statistics and Informatics in Agricultural Research (ICSI 2012)** by the Indian Society of Agricultural Statistics as its 66th Annual Conference during 18-20 December 2012 at Indian Agricultural Statistics Research Institute, New Delhi. Dr. VK Gupta was the Organizing Chair, Dr. VK Bhatia was the Organizing Co-Chair and Dr. Rajender Parsad was the organizing secretary for the Conference. The conference was attended by more than 250 delegates from 6 different countries (USA, Canada, Jordan, Sri Lanka, Botswana and India). There were 3 memorial lectures, one keynote address, two plenary talks and 3 distinguished lectures. 20 sessions of invited papers (including one Panel discussion on Knowledge Management in Agriculture) were also organised. More than 140 contributed papers were presented in 14 different

sessions. Following sessions were convened by the scientists of the Institute:

Advances in Statistical Genetics: Dr. VK Bhatia and Dr. AR Rao

HRD in Agricultural Statistics and Informatics:
Current Status and Challenges: Dr. VK Gupta

Small Area Estimation: Dr. Hukum Chandra

TEACHER'S DAY CELEBRATIONS

The Institute celebrated Teacher's Day on 05 September 2012 and honored Dr. SK Raheja and Dr. BBPS Goel, Former Directors IASRI. Dr. Alope Dey, Senior Scientist, INSA delivered Dr. Daroga Singh Memorial lecture on this occasion. Dr. VK Gupta, National Professor, ICAR, New Delhi presided over the function. Dr. Rajender Parsad, Professor (Agricultural Statistics) was the convener of the celebration.

ANNUAL DAY CELEBRATIONS

The Institute celebrated its 53rd Annual Day on 02 July 2012. Dr. Padam Singh, Former Member, National Statistical Commission, Govt. of India and Head EPOS Health Consultants (India) Pvt. Ltd. presided over the function and Dr. Gurbachan Singh, Chairman, Agricultural Scientists Recruitment Board, ICAR, New Delhi delivered the Nehru Memorial Lecture on “Food and Nutrition Security”. Nehru Memorial Gold Medal for the year 2009-11 was awarded to Sh. Samarendra Das, M.Sc. (Agricultural Statistics) student and Ms. Satma M.C., M.Sc. (Computer Application) student. The Annual

Report of the Institute for the year 2011-12 was also released on this occasion.

SEMINARS

Salient outcomes from the completed research projects undertaken on different aspects of Agricultural Statistics and 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) and M.Sc., (Computer Application) and M.Sc. (Bioinformatics). During the period under report, a total of 108 seminar talks were delivered. Out of these, 78 were student seminars, 22 by scientists of the Institute and 08 by Guest Speakers as follows:

Guest Seminars

- Dr. Asha Seth Kapadia, Professor of Biostatistics, Management and Policy Sciences, University of Texas, School of Public Health, Houston, USA on Current Issues in Public Health.
- Mr. Biswajit Nayak, Stat Soft India, on A demo on ANN and SVM through Statistica Software.
- Dr. Madan Kumar Bhattacharya, Professor, Iowa State University, USA on One Possible Mechanism involved in Foliar Sudden Death Syndrome Development in Soybean.
- Dr. Pushpendra Gupta, NASI-Senior Scientist on Recent Advances in Quantitative Genetics
- Dr. Shyamal D. Peddada, Biostatistics Branch, National Institute of Environmental Health Sciences (NIH), Research Triangle Park, NC 27709 on Identification of a Set of Signature Cell-Cycle Genes whose Relative Phase Order is Conserved Across Species.
- Prof. Balgobin Nandram, Department of Mathematics and Statistics, Concordia University, Montreal, Canada on Assessing correlations in a Bayesian Analysis of a Small Area Finite Population Proportion.
- Prof. Yogendra P Chaubey, Department of Mathematics and Statistics, Concordia University, Montreal, Canada on Symmetrising and Variance Stabilizing Transformations.
- Prof. RS Chhikara, School of Natural and Applied Sciences, University of Houston – Clear Lake, Texas, USA on Modelling Repeated Observations of Blood Volume in Muscle Microcirculation.



SYMPOSIA / WORKSHOPS ORGANISED UNDER VARIOUS PROJECTS

S. No.	Title	Venue	Date
1.	Workshop cum training programme on Web Enabled Information System for On Farm Research Experiments for OFR Agronomists under PDFSR, Modipuram	IASRI, New Delhi	20-21 April 2012
2.	Requirement Analysis Workshop for ICAR ERP under the NAIP Project Implementation of Management Information System (MIS) including Financial Management System (FMS) in ICAR	IASRI, New Delhi	30 April to 05 May 2012
3.	Workshop for Nodal Officers of NAIP Consortium on Strengthening Statistical Computing for NARS	IASRI, New Delhi	25 June 2012
4.	Workshop-cum-Installation Training Programme for Nodal Officers of NAIP Consortium on Strengthening Statistical Computing for NARS	IASRI, New Delhi	26 June 2012
5.	Workshop on Evaluation of Agriculture Census Scheme (EACS) and Training for Input Survey 2011-12 funded by Agriculture Census Division (ACD), DAC, Ministry of Agriculture, Govt. of India, New Delhi	IASRI, New Delhi	28-29 June 2012
6.	Partner's meet of NAIP project Establishment of National Agricultural Bioinformatics Grid	IASRI, New Delhi	19-21 July 2012



7.	Data Digitization Awareness Workshop under MIS/FMS Project	IASRI, New Delhi	12 September 2012
8.	Brain-storming Workshop to Discuss Draft RFD	IASRI, New Delhi	04 January 2013
9.	Sensitization Workshop under Strengthening Statistical Computing for NARS	Sardar Ballabh Bhai Patel University of Agricultural and Technology, Modipuram, Meerut	13-14 March 2013
हिन्दी कार्यशाला			
10.	एम.एस.-एक्सेल संयोजक : सिनी वर्गीस सुशील कुमार सरकार	भा.कृ.सां.अ.स., नई दिल्ली	27 नवम्बर 2012
11.	मेल-मर्ज संयोजक : नरेश चन्द पन्ना लाल गुप्ता	भा.कृ.सां.अ.स., नई दिल्ली	07 मार्च 2013
FOR NODAL OFFICERS OF NISAGENET			
12.	Appraisal cum Data Validation Workshop Resource Person: RC Goyal & Pal Singh	Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu, J&K	12-13 September 2012
13.	Appraisal cum Data Validation Workshop Resource Person: RC Goyal	TANUVAS, Chennai	20-21 December 2012
14.	Appraisal cum Data Validation Workshop for ANGRAU Resource Person: RC Goyal	College of Agriculture, ANGRAU, Andhra Pradesh	23 January 2013
15.	Appraisal cum Data Validation Workshop Resource Person: RC Goyal	Banaras Hindu University, Varanasi	19-20 March 2013



WEB GENERATION OF EXPERIMENTAL DESIGNS BALANCED FOR INDIRECT EFFECTS OF TREATMENTS

[Home](#)

[Neighbour Balanced Design](#)

[Crossover Design](#)

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About Design

Catalogue

Generate Design

Williams Square CODs

Extra-Period Williams Square CODs

Two-Period CODs

Strongly Balanced CODs

Totally Balanced Complete Sequence CODs

Totally Balanced Incomplete Sequence CODs

Complete/Incomplete Sequence CODs (e)

Using MOLS

Minimal Balanced CODs

This webpage generates following two categories of experimental designs balanced for indirect effects of treatments:

Neighbour Balanced Designs (v treatments, b blocks, r replicates)

Crossover Designs (v treatments, p periods and n units)

It displays the layout plans along with the randomized layout for given number of treatments. The parameters of the designs so generated are also displayed.

Crossover design for $v = 5, p = 5, n = 10$

Periods	Experimental Units									
	1	2	3	4	5	6	7	8	9	10
1	4	1	5	2	3	5	1	2	3	4
2	3	5	4	1	2	1	2	3	4	5
3	5	2	1	3	4	4	5	1	2	3
4	2	4	3	5	1	2	3	4	5	1
5	1	3	2	4	5	3	4	5	1	2



Distinguished Visitors

INDIAN

Dr. S Ayyappan

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

Dr. MM Pandey

DDG (Engineering), ICAR, New Delhi

Dr. BB Singh

DDG, ICAR, New Delhi

Dr. AK Singh

DDG (NRM)

Dr. Padam Singh

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

Dr. Alope Dey

INSA Senior Scientist
Indian Statistical Institute, New Delhi

Prof. Prem Narain

Former Director, IASRI, New Delhi

Dr. BBPS Goel

Former Director, IASRI, New Delhi

Dr. SD Sharma

Vice-Chancellor
Dev Sanskriti Vishwavidhyalya, Haridwar

Dr. NPS Sirohi

ADG (Engineering), ICAR, New Delhi

Dr. Kusumakar Sharma

ADG (HRD), ICAR, New Delhi

Dr. B Gangwar

Director, PDFSR, Modipuram

Dr. PS Pandey

National Coordinator
NAIP, ICAR, New Delhi

Dr. A Dhandapani

Principal Scientist, NAARM, Hyderabad

Dr. (Smt.) Rajni Jain

Senior Scientist, NCAP, New Delhi

Dr. Vidya Dhar

DDG & Agriculture Census Commissioner
Government of India

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Agriculture Statistics & Crop Insurance
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Sh. Rajiv Lochan

Advisor,
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West Bengal State University

Dr. SN Mishra

Chairman,
Centre of Economic and Social Research &
Former Director, Institute of Economic Growth
Delhi

Dr. Milap Punia

Associate Professor, JNU, New Delhi

Sh. Pramod Kumar Sharma

Field Demonstrator DSO (State Govt. U.P.)

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IARI, New Delhi

Dr. Niranjan Prasad

Head
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IINRG, Ranchi

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Dr. RN Sahoo

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IARI, New Delhi

Dr. Randhir Singh

Former Principal Scientist, IASRI, New Delhi

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ADG,
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Ministry of Water Resources
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Group Director,
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Mr. Biswajit Nayak

Stat Soft India

Dr. Pushpendra Gupta

NASI-Senior Scientist

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Professor of Biostatistics
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Prof. I Ngalinda

Eastern Africa Statistical Training Centre (EASTC),
Tanzania

H.E. Mr. Abdul Rahman Ghafoori

President
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Prof. RS Chhikara

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University of Houston – Clear Lake
Texas, USA





ppe: microdb

Pigeonpea Microsatellite Database



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Chromosomes (More than 1 can be selected at a time)

Chromosome 1 ▲
Chromosome 2
Chromosome 3 ▼
Chromosome 4

Microsatellite characteristics (Choose any of these types)

Motif type ▼

Repeat motif

Repeat kind ▼

Limit your search (Advanced Search):

Chromosomal Location between and find markers in the range

GC Content (%) between and (Range 1-100)

Exons between and



ppe: microdb

Pigeonpea Microsatellite Database



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, Amar Singh and

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, Mahesh Chand Meena, IASRI: Amrit Kumar Paul: 01.04.2009–31.03.2014

4. **Mating-environmental designs under two-way blocking setup. (SIX1202)**

Eldho Varghese and Cini Varghese: 15.03.2012–30.09.2013

5. **Main effects linear trend-free multi-level factorial experiments. (SIX1205)**

Susheel Kumar Sarkar, Krishan Lal and VK Gupta : 27.03.2012–15.09.2013

Outside Funded

6. **Experimental designs in the presence of indirect effects of treatments. (DST Funded). (SOX1115)**

Seema Jaggi, Cini Varghese, Anu Sharma and Eldho Varghese: 01.10.2011–30.09.2014

Completed

Institute Funded

7. **Analysis of experimental designs with *t*-family of error distributions. (SIX1006)**

Krishan Lal, Rajender Parsad (upto 31.03.2011),VK Gupta and Lalmohan Bhar (till 24.09.2011): 01.05.2010–20.09.2012

8. **Efficacy of soil sampling strategies for describing spatial variability of soil attributes (Collaboration with IISS, Bhopal association w.e.f. 01.11.2011) (CIP1124)**

IISS, Bhopal: Neenu S, S Srivastava, IASRI: BN Mandal: 01.08.2010–30.09.2012

9. **Efficient designs for drug testing in veterinary trials. (SIX1104)**
Cini Varghese: 01.06.2011–30.09.2012
10. **Application of optimization techniques for construction of incomplete block designs. (SIX1116)**
BN Mandal, Rajender Parsad and VK Gupta: 01.10.2011–31.03.2013

New Initiated

Institute Funded

11. **Planning, designing and analysis of data relating to experiments for AICRP on long-term fertilizer experiments. (SIX1206)**
Krishan Lal, DK Sehgal (till 31.08.2012) and BN Mandal (since 01.10.2012): 01.04.2012–31.03.2014
12. **Planning, designing and analysis of 'On Farm' research experiments planned under PDFSR. (SIX1207)**
NK Sharma and Sukanta Dash (since 01.10.2012): 01.04.2012–31.03.2014
13. **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 (since 01.10.2012): 01.04.2012–31.03.2017
14. **Planning, designing and analysis of experiments planned 'On Stations' under PDFSR. (SIX01209)**
Anil Kumar, Rajendra Kumar (till 31.10.2012) and Eldho Varghese (since 01.10.2012): 01.04.2012–31.03.2014
15. **Row-column designs for factorial experiments in two rows. (AGENIASRISIL201200100001)**
Sukanta Dash, Rajender Parsad and VK Gupta: 04.10.2012–31.03.2014
16. **Experimental designs for polycross trials. (AGENIASRISIL201300200003)**
Cini Varghese, Seema Jaggi and Eldho Varghese: 04.02.2013–31.07.2014

Outside Funded

17. **Bioacoustics tool: A novel non-invasive approach for different monitoring of health and productivity in dairy animals. (AGENIASRICOL201300400005)**
NDRI, Karnal: Surender Singh Lathwal, Shiv Prasad, TK Mohanty, Archana Verma, AP Ruhil and SV Singh
IASRI: Anil Kumar: 01.02.2013-31.01.2016

FORECASTING, MODELLING AND SIMULATION TECHNIQUES IN BIOLOGICAL AND ECONOMIC PHENOMENA

On-going

Institute Funded

18. **Forecasting models using functional data analysis and nonlinear support vector regression techniques. (SIX1117)**
Mir Asif Iqbal and Prajneshu: 04.10.2011–30.06.2013
19. **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
20. **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 (since 28.03.2012): 04.11.2011–30.06.2013



- 21. 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
- 22. 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), Sanjeev Panwar (since 23.09.2011 as Co-PI and since 01.03.2013 as PI), LM Bhar (till 24.09.2011) and Ranjana Agrawal (till 23.09.2011) and **DCFR, Bhimtal :** Prem Kumar (since 23.09.2011): 20.08.2011–30.04.2013
- 23. 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, AY Munj, **AES, Paria:** NI Shah, Hemant Sharma and GB Kalariya, **BCKV, Mohanpur:** SK Ray, A Samanta, **BAC, Sabour:** Rajesh Kumar, SN Ray and Mithesh Kumar, **FRS Sangareddy:** A Bhagwan, B Mahindar and D Anitha Kumari: 01.04.2010-31.07.2013
- 24. A study of stochastic volatility models through particle filtering. (SIX1201)**
Bishal Gurung and Himadri Ghosh: 02.02.2012–30.06.2013

Outside Funded

- 25. 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 and **IASRI:** Amrender Kumar and KN Singh (since 01.10.2012): 01.06.2011–31.03.2017
- 26. 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 and **IASRI:** Ranjit Kumar Paul: 29.08.2011–26.08.2014

Completed

Institute Funded

- 27. Development of forecasting module for podfly, *Melanagromyza Obtusa Malloch* in the late pigeon pea' (Collaboration with IIPR, Kanpur association w.e.f. 01.01.2009). (CIP0710)**
Ranjana Agrawal and Amrender Kumar (till 23.09.2011): 01.07.2007–30.09.2012
- 28. Weather based forewarning models for onion thrips (*Thrips tabaci Lindeman*) (Collaboration with Directorate of Onion and Garlic Research, Pune). (CIP1004)**
IASRI: Amrender Kumar, Ranjana Agrawal and **DOGR, Pune:** PS Srinivas (till 30.11.2011), Jayanthi Mala BR (since 01.12.2010): 01.04.2010–05.03.2013
- 29. Study of asymmetry in retail-wholesale price transmission for selected essential commodities. (SIX1123)**
SP Bhardwaj, Ashok Kumar (till 31.07.2012) and Sanjeev Panwar: 03.11.2011–31.03.2013

Outside Funded

- 30. Visioning, Policy Analysis and Gender (V-PAGE) Sub Program II: Technology forecasting and policy analysis (NAIP Component I: Consortium Partner) (COP0708)**
NCAP: Ramesh Chand, P Ramasundaram, **IASRI:** VK Bhatia, Ramasubramanian V, Anil Rai, KK Chaturvedi (till 31.08.2010) and Amrender Kumar: 01.06.2007–30.06.2012

New Initiated

Institute Funded

- 31. Study of commodity price forecast based on time series data. (AGENIASRISIL201300300004)**
SP Bhardwaj, DR Singh, KN Singh and Ranjit Kumar Paul: 18.02.2013–28.02.2015

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

On-going

Institute Funded

- 32. Study of sample sizes for estimation of area and production of food grain crops (SIX1125)**
KK Tyagi, AK Gupta, VK Jain and Kaustav Aditya : 14.11.2011–30.04.2013
- 33. On small area inference using survey weights. (SIX1107)**
IASRI: Hukum Chandra and VK Jain, **DWSR, Jabalpur:** Yogita Gharde (since 12.10.2012): 06.08.2011–31.05.2013
- 34. Spatial non-stationarity in small area estimation under area level model. (SIX1114)**
Hukum Chandra, UC Sud and Yogita Gharde (till 31.03.2012): 01.10.2011–31.07.2013
- 35. 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: 10.10.2011–31.07.2013
- 36. 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 (since 25.02.2011) and Satish Lande (since 25.02.2011), **IASRI:** Tauqueer Ahmad: 01.04.2009–31.03.2014

Completed

Outside Funded

- 37. Policy Analysis and Market Intelligence (Sub-Prog. III) of Visioning Policy Analysis and Gender (V-PAGe) project (NAIP Component I: Consortium Partner) (COP0709)**
NCAP: Ramesh Chand, P Ramasundaram and Pratap Singh (till May 2008); **IASRI:** VK Bhatia, AK Vasisht (till 01.03.2010), DR Singh, Ashok Kumar, SP Bhardwaj, Prawin Arya, Sushila Kaul (till 30.03.2010), Anil Rai, KK Chaturvedi (till 31.08.2010) and N Sivaramane, **IARI:** NP Singh (till July 2008): 01.06.2007–30.06.2012

New Initiated

Institute Funded

- 38. A study on calibration estimators of finite population total for two stage sampling design. (SIX1211)**
Kaustav Aditya, UC Sud, Hukum Chandra and VK Jain: 01.04.2012-31.03.2014
- 39. Small area estimation for skewed data. (AGENIASRISIL201300100002)**
Hukum Chandra, UC Sud and Kaustav Aditya: 19.01.2013-31.12.2014



Outside Funded

40. **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 and RK Vishwakarma, **IASRI:** Tauqueer Ahmad, UC Sud (till 26.11.2012), Anil Rai and PM Sahoo: 01.02.2012–31.03.2014

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

On-going

Institute Funded

41. **Analysis and determination of antimicrobial peptides: A machine learning approach. (SIX1121)**
 Sarika and Mir Asif Iquebal: 01.11.2011–30.09.2013
42. **Study of synonymous codon usage and its relation with gene expressivity in genomes of halophilic bacteria (Collaboration with NABIM, Mau). (CIL1108)**
IASRI: Samir Farooqi and Dwijesh Chand Mishra, **NABIM, Mau:** DP Singh and KK Meena: 01.08.2011–15.04.2013
43. **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, Kishore Gaikwad, **IASRI:** AR Rao: 01.04.2009–31.03.2014*
 * The RAC of NRCPB has recommended to windup the project on 31 March 2012 and asked to continue the project for the next five year plan, i.e., 2012-2017.
44. **In silico identification of abiotic stress (Salinity) responsive transcription factor and their cis-regulatory elements in grapes (*Vitis vinifera*). (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

45. **Whole Genome Association (WGA) analysis in common complex diseases: An Indian initiative (Centre of Excellence in Genome Science and Predictive Medicine) (DBT funded). (COP0807)**
UDSC: BK Thelma, **NII:** Ramesh C. Juyal, **DU:** Sanjay Jain, **IASRI:** AR Rao and SD Wahi (since 22.06.2010)
AIIMS: Ashok Kumar, **DMC:** Ajit Sood: 29.09.2008–28.09.2013
46. **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
47. **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 and Alka Arora, **IIT:** S Chaudhury, **University of Delhi South Campus:** 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
48. **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

New Initiated

Institute Funded

- 49. Algorithm for gene classification based on gene expression data. (SIX1210)**
DC Mishra and Sanjeev Kumar: 01.04.2012–31.03.2014
- 50. Study on robustness of sequential testing procedures for some distributions used in agricultural pest control. (SIX1212)**
Wasi Alam: 01.04.2012–30.09.2013
- 51. Parallelized workflows for gene prediction, phylogenetic analysis and primer designing. (SIX1219)**
SB Lal, Anu Sharma and Sarika: 28.08.2012–31.07.2014

DEVELOPMENT OF INFORMATICS IN AGRICULTURAL RESEARCH

On-going

Institute Funded

- 52. Project Information and management system of ICAR (PIMS-ICAR). (SIX0901)**
RC Goyal, PK Malhotra, Sudeep, Alka Arora and Pal Singh: 01.01.2009–31.03.2014
- 53. 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: 25.04.2011–24.10.2013
- 54. Exploration of central data warehouse for knowledge discovery. (SIX1127)**
Anshu Bharadwaj, SN Islam and DR Singh: 09.12.2011–31.05.2013
- 55. 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 (since 01.03.2012), Yogesh Gautam (since 01.10.2011), Hari Om Agarwal (till 29.02.2012) and Harnam Singh Sikarwar (till 01.02.2012), **AICRP Centers:** Robin Gogoi (IARI), G Nallathambi (Coimbatore), Mruthunjaya C Wali (Arbhavi), SR Kulkarni (Kolhapur), SM Khanorkar (Godra), Dev Raj Lenka (Bhubaneswar), JP Shahi (Varanasi), SPS Brar (Ludhiana), Bashir Ahmad Alaie (Srinagar), Dilip Singh (Banswara) and NS Barua (Assam) : 01.04.2011–31.03.2016
- 56. 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 (since 13.02.2013), Ravinder Singh (since 13.02.2013), JK Ranjan (since 13.02.2013), RK Solanki (since 13.02.2013) and SS Rathore (since 13.02.2013): 17.12.2011–30.09.2013
- 57. Web based software for codon usage analysis for gene expression identification. (SIX1204)**
Anu Sharma, SB Lal and Dwijesh Chandra Mishra: 16.03.2012-15.05.2013

Outside Funded

- 58. Strengthening Statistical Computing for NARS (NAIP Component I: Consortium Leader). (COL0908)**
VK Bhatia (till 28.02.2013) Director (IASRI), Rajender Parsad, PK Malhotra (till 31.03.2011), VK Mahajan (till 31.03.2011), Seema Jaggi, Samir Farooqui, Ramasubramanian V, LM Bhar, AK Paul, N Sivaramane (till March 2012): 20.04.2009–31.03.2014



59. Establishment of National Agricultural Bioinformatics Grid in ICAR (NAIP funded). (COL1002)

VK Bhatia (till 28.02.2013) Director (IASRI), Anil Rai, PK Malhotra (till 31.03.2011), KK Chaturvedi (till 31.08.2010), Dinesh Kumar, SB Lal, Anu Sharma, Samir Farooqi, Sudeep (till 31.03.2011), Hukum Chandra, AR Rao, Seema Jaggi, Sanjeev Kumar (since 01.09.2011) and Sarika (since 03.09.2012): 01.04.2010–31.03.2014

60. Implementation of Management Information System (MIS) including Financial Management System (FMS) in ICAR. (COL1203)

VK Bhatia (till 14.02.2013), AK Choubey (since 15.02.2013), Alka Arora, Sudeep, Shashi Dahiya, Soumen Pal (till 30.09.2012), SN Islam (since 11.06.2012) and Anshu Bharadwaj (since 15.03.2013): 19.01.2012–31.03.2014

Completed

Institute Funded

61. Development of web based mushroom expert system (Lead Centre: Directorate of Mushroom Research, Solan, HP). (CIP1110)

DMR, Solan: Mahantesh Shirur, B Vijay, RC Upadhyay, VP Sharma, OP Ahlawat, Satish Kumar, Shwet Kamal, Goraksha C Wokchaure and K Manikandan, **IASRI:** Yogesh Gautam, Hari Om Agarwal (till 29.02.2012), Pal Singh and Harnam Singh (till 01.02.2012): 01.04.2011–30.09.2012

62. Development of web enabled Statistical Package for Factorial Experiments (SPFE 2.0). (SIX1126)

Sangeeta Ahuja and PK Malhotra: 17.11.2011–31.03.2013

New Initiated

Institute Funded

63. Development of scientific monitoring system and database design for the HYPM. (SIX1216)

RC Goyal, Sudeep and Alka Arora: 01.04.2012–30.06.2013

64. Management system for post graduate education - II. (SIX1218)

Sudeep, PK Malhotra, RC Goyal and Yogesh Gautam: 01.04.2012–31.03.2017

65. National information system on agricultural education network in India. (NISAGENET-IV). (SIX1217)

RC Goyal, Alka Arora, Pal Singh, Shashi Dahiya and Soumen Pal (till 30.09.2012): 01.04.2012–31.03.2017

Outside Funded Projects

66. A new distributed computing frame work for data mining. (Funded by Department of Information Technology association w.e.f. 01.11.2012). (COP1222)

BITS, Pilani: Navneet Goyal, Poonam Goyal and Sundar Balasubramaniam, **IASRI:** Sanjeev Kumar: 15.10.2012–14.10.2015

CONSULTANCY PROJECTS: (02)

Development of Techniques for Planning and Execution of Surveys and Analysis of Data including Economic Problems of Current Interest

On-going

67. Study to develop an alternative methodology for estimation of cotton production. (Funded by Directorate of Economics and Statistics (DES), Ministry of Agriculture, Govt. of India).

Tauqueer Ahmad, VK Bhatia (till 28.02.2013), UC Sud, Anil Rai and Prachi Misra Sahoo : 01.04.2011–31.07.2013

New Initiated

68. Impact assessment of agro forestry model in Vaishali district of Bihar State

Tauqueer Ahmad, VK Bhatia (till 28.02.2013), UC Sud, Anil Rai and Prachi Mishra Sahoo: 10.09.2012–09.05.2013

VARIOUS COMMITTEES

Prioritization, Monitoring & Evaluation Cell

Dr. Rajender Parsad, Head (Design of Experiments)	In-charge (till 26.08.2012)
Dr. Seema Jaggi, Principal Scientist	In-charge (w.e.f. 27.08.2012)
	Member (till 26.08.2012)
Dr. UC Sud, Head (Sample Surveys) & RFD Nodal Officer	Member
Dr. Tauqueer Ahmad, Senior Scientist	Member
Dr. Sivaramane N, Scientist	Member

Consultancy Processing Cell (CPC)

Dr. Prajneshu, Head (Statistical Genetics) and Professor (Bioinformatics)	Chairman
Dr. PK Malhotra, Professor (Computer Application)	Member
Dr. Rajender Parsad, Head (Design of Experiments) and Professor (Agricultural Statistics)	Member
Dr. Seema Jaggi, Principal Scientist & Incharge PME Cell	Member (w.e.f. 15.09.2012)
Head of Office (Ex-officio)	Member
Finance and Accounts Officer (Ex-officio)	Member
Sh. PP Singh, Technical Officer (T-9)	Member Secretary

Institute Technology Management Committee (ITMC)

Dr. VK Bhatia, Director, IASRI	Chairman (till 28.02.2013)
Dr. UC Sud, Director (A), IASRI	Chairman (w.e.f. 01.03.2013)
Dr. Rajender Parsad, Head (Design of Experiments) Professor (Agricultural Statistics) and In-charge ITMU	Member Secretary
Dr. PK Malhotra, Professor (Computer Application)	Member
Dr. Anil Rai, Head (Centre for Agricultural Bioinformatics) (Technical Expert–A Scientist of the Institute)	Member
Dr. Seema Jaggi, Principal Scientist (Technical Expert–A Scientist of the Institute)	Member
Dr. Madhuban Gopal, Principal Scientist & National Fellow, IARI (IPR Expert–A Scientist from ICAR Institute in the Zone)	Member

Institute Technology Management Unit (ITMU)

Dr. Rajender Parsad, Head (Design of Experiments) & Professor (Agricultural Statistics)	Officer In-charge
Dr. Tauqueer Ahmad, Senior Scientist	Member
Sh. PP Singh, Technical Officer (T-9)	Member



Institute Results-Framework Document (RFD) Committee is Chaired by the Director. All Heads of Divisions, Officer In-charge (PME Cell), Professors of Agricultural Statistics, Computer Application and Bioinformatics, Chief Administrative Officer and Senior Finance & Accounts Officer are its Members. Dr. UC Sud, Head (Division of Sample Surveys) is the RFD Nodal Officer who acts as its Member-Secretary. Dr KK Tyagi, Principal Scientist, Division of Sample Surveys is the RFD Co-Nodal Officer. Besides this, the RFD Cell of the Institute comprises of RFD Nodal Officer as its Chairman. Co-Nodal Officer, Sh. VK Jain, Dr. AK Mogha and Sh. Bikram Singh are the members of the Cell.

Institute Deputation Committee

Director	Chairman
All Heads	Members
CAO	Member
F&AO	Member
Incharge PME	Member Secretary

Project Monitoring Committee (PMC) is chaired by Director, all Head of Divisions are its members and In-charge PME Cell is the Member Secretary.

Institute Joint Staff Council

Director	Chairman
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Official-side Representatives

Sh. KPS Gautam, Head of Office	Member Secretary
Dr. PK Malhotra, Head (Computer Application)	Member
Dr. UC Sud, Head (Sample Surveys) and Welfare Officer	Member
Dr. Rajender Parsad, Head (Design Experiments) & In-charge PME Cell (till 26.08.2012)	Member
Dr. KK Tyagi, Principal Scientist	Member
Sh. Vijay Kumar, F&AO	Member

Staff-side Representatives

Sh. KB Sharma, Assistant	Secretary
Sh. Rajesh Kumar, T-2	Member (till 28.02.2013)
Sh. Virender Kumar, Technical Officer (T-5)	Member
Sh. Mukesh Kumar, LDC	Member
Sh. Rajnath, Skilled Supporting Staff	Member
Sh. Ashok Kumar, Skilled Supporting Staff	Member

Institute Grievance Committee

Official-side Representatives

Director	Chairman
Head of Office	Member
Dr. (Smt.) Ranjana Agrawal, Principal Scientist	Member
Sh. Vijay Kumar, F&AO	Member
Assistant Administrative Officer (Admn. II)	Member Secretary

Staff-side Representatives

Sh. Pal Singh, Scientist (SS)	Member
Sh. Satya Pal Singh, Technical Officer (T-6)	Member
Sh. Basant Kumar, UDC	Member
Sh. Mohan Singh, Skilled Supporting Staff	Member

ICAR Staff Welfare Fund Scheme

Dr. UC Sud, Head (Sample Surveys) & Welfare Officer	Chairman
Dr. KK Tyagi, Principal Scientist	Member
Sh. KPS Gautam, Head of Office	Member
F&AO	Member
Dr. (Smt.) Seema Jaggi, Principal Scientist	Lady Member
Sh. KB Sharma, Assistant & Secretary, IJSC	Member
Sh. Mahendra Pandit, Skilled Supporting Staff	Member
Sh. Chander Vallabh, AAO (Admn. II)	Member Secretary

Women Cell

Dr. Ranjana Agrawal, Principal Scientist	Chairperson
Dr. Seema Jaggi, Principal Scientist	Member
Ms. Vijay Bindal, Technical Officer (T-9)	Member
Smt. Suman Khanna, Steno	Member
Smt. Sushma Gupta, Assistant Administrative Officer	Convener

Canteen Committee

Head of Office	Chairman
Dr. UC Sud, Head (Sample Surveys) & Welfare Officer	Member
Sh. Vijay Kumar, F&AO	Member
Assistant Administrative Officer (Admn. II)	Member
Smt. Savita Wadhwa	Lady Member
Sh. SK Sublania, MTO(T-9)	Member Secretary

International Training Hostel (ITH)/Panse Guest House

A total of 1321 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 2308 guests stayed at Panse Guest House during the period under report. Smt. Sushma Banati (superannuated on May 2012) was the In-charge and presently, Sh. RK Koli, AAO is the In-charge of the Guest Houses. Sh. Sunil Kumar is the Caretaker of the Guest Houses.

Hostel Executive Committee

Warden	Ranjana Agrawal
Prefect	Kader Ali Sarkar
Assistant Prefect /Mess Secretary	Prakash Kumar



Cashier
Cultural Secretary
Assistant Cultural Secretary
Maintenance Secretary
Assistant Maintenance Secretary

Health Secretary
Sports Secretary
Assistant Sports Secretary
Common Room Secretary
Gym Secretary
Computer Lab Secretary
Auditors

Warden's Nominee

Institute Recreation Club

Dr. VK Bhatia, Director
Dr. UC Sud, Director(A)
Sh. OP Khanduri, Senior Scientist
Sh. RS Tomar, Technical Officer
Sh. Sunil Bhatia, Technical Officer
Sh. Raj Kumar Verma, UDC
Sh. Mukesh Kumar, LDC
Sh. Sunil Kumar-I, LDC
Smt. Vijay Laxmi Murthy, P.A.

Institute Sports Committee

Dr. VK Bhatia, Director
Dr. UC Sud, Director(A)
Dr. KN Singh, Head, Forecasting and Agricultural
Systems Modelling
Sh. OP Khanduri, Senior Scientist
Senior Administrative Officer
Finance & Accounts Officer
Sh. Chander Vallabh, AAO
Sh. PS Rai, AAO
Sh. RS Tomar, Technical Officer
Sh. KB Sharma, Assistant & Secretary, IJSC

Raju Kumar
Swetank Lal
Sarvana Kumar
Satish Kumar Yadav
Pradip Basak
Arvind Kumar
Amit Kairi
Tanuj Mishra
Niranjan Nayak
Soumya Ranjan Bardhan
Shashi Shekhar
Achal Lama
Rohan Raman
Mrinmoy Ray
Sunil Yadav
Nirupam Ghosh

President (till 28.02.2013)
President (w.e.f. 01.03.2013)
Vice President
Secretary
Treasurer
Member
Member
Member
Lady Member

President (till 28.02.2013)
President (w.e.f. 01.03.2013)
Vice President
Vice President
Member
Member
Convener
Member
Member
Member



Sh. Rambhool, UDC

Member

Smt. Meena Nanda, Technical Officer

Lady Member

IASRI Employees Co-operative Thrift and Credit Society Limited

Dr. VK Bhatia, Director

Patron (till 28.02.2012)

Dr. UC Sud, Director (A)

Patron (w.e.f. 01.03.2013)

Sh. UC Bandooni

President

Ms. Vijay Bindal

Vice-President

Sh. Pratap Singh

Secretary

Sh. Pradeep Kumar

Treasurer

Mrs. Vijay Laxmi Murthy

Member

Mrs. Savita Wadhwa

Member

Sh. Manoj Kumar

Member

Sh. Ram Bhool

Member

Sh. NK Sharma

Member

Sh. Parbhu Dayal

Member

Sh. Rajnath

Member



Annexure-III

IASRI PERSONNEL

Dr. VK Bhatia, Director (till 28.02.2013)

Dr. UC Sud, Director (A) (w.e.f. 01.03.2013)

National Professor (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

Head, Centre for Agricultural Bioinformatics

Dr. Anil Rai

Head, Division of Forecasting & Agricultural Systems Modeling

Dr. KN Singh

Head, Division of Computer Application

Dr. PK Malhotra (A) (till 21.01.2013)

Dr. AK Chaubey (w.e.f. 22.01.2013)

Professor (Agricultural Statistics)

Dr. Rajender Parsad

Professor (Computer Application)

Dr. PK Malhotra

Professor (Bioinformatics)

Dr. Prajneshu

Warden, Sukhatme Hostel

Dr. (Smt.) Ranjana Agrawal

In-Charge, Prioritization, Monitoring & Evaluation (PME) Cell

Dr. Rajender Parsad (till 26.08.2012)

Dr. Seema Jaggi (w.e.f. 27.08.2012)

Vigilance Officer

Dr. PK Malhotra (till 31.10.2012)

Dr. UC Sud (w.e.f. 01.11.2012)

Transparency Officer & Nodal Officer

Dr. Prajneshu

Welfare Officer

Dr. UC Sud

In-Charge, Institute Technology Management Unit

Dr. Rajender Parsad

In-Charge, National Agricultural Science Museum

Dr. (Smt.) Sushila Kaul

Cheif Administrative Officer

Sh. KPS Gautam

Finance and Accounts Officer

Sh. Vijay Kumar (till 28.02.2013)

Sr. Finance and Accounts Officer

Sh. AP Sharma (w.e.f. 07.11.2012)

Librarian

Sh. Praveen Kumar Saxena

Public Information Officer

Sh. KPS Gautam

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, Govt. 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, Deputy Director General (Engineering)	Chairman
Dr. NPS Sirohi, Assistant Director General (Engineering)	Member
Dr. AK Vasisht, Assistant Director General (PIM)	Member
Dr. RC Agrawal, Registrar General, PPV&FR,GOI	Member
Dr. VK Bhatia, Director, IASRI (till 28.02.2013)	Member
Dr. UC Sud, Director (A), IASRI (w.e.f. 01.03.2013)	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

Participation of NASM in Different Events

- Pusa Krishi Vigyan Mela at Indian Agricultural Research Institute, New Delhi during 06-08 March 2013

Distinguished Visitors

Ethiopia, Mozambique, Botswana, France, Myanmar, Malaysia, Philippines, Thailand, Indonesia, Cambodia, Lao PDR, Vietnam, Singapore, Brazil, Russia, South Africa, Bangladesh, USA, Honduras, Iraq, Lebanon, Morocco, Nigeria, North Korea, Uzbekistan, United Kingdom, Georgia, Gambia, Srilanka and Afghanistan

In all, 23538 visitors visited the Museum and 2601 tickets were sold. Students from 53 schools of Delhi, 9 schools of Haryana and 1 school each from Uttar Pradesh and Andhra Pradesh visited NASM. Students from Universities of 17 states and farmers from 21 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.

