ICAR-IASRI

Annual Report

2015-16

ICAR - Indian Agricultural Statistics Research Institute

Library Avenue, Pusa, New Delhi - 110012

www.iasri.res.in

ISO 9001:2008 Certified Institute

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

Annual Report
2015-16

ICAR - Indian Agricultural Statistics Research Institute

Library Avenue, Pusa, New Delhi - 110012

www.iasri.res.in

ISO 9001:2008 Certified Institute

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

Published by
Prioritization Monitoring and Evaluation Cell
on behalf of
Director
ICAR-Indian Agricultural Statistics Research Institute
Library Avenue, Pusa, New Delhi- 110 012
Phone : 011-25841479
Fax : 011-25841564
E-mail : director@iasri.res.in; director.iasri@icar.gov.in;
pme@iasri.res.in; pme.iasri@icar.gov.in
Website : http://www.iasri.res.in
Published in 2016

Compiled and Edited by

Ajit, Naresh Chand, Vijay Bindal, PP Singh, Anil Kumar and Jyoti Gangwani

Cover/Back page Design and Concept

Ajit

Contents

	Preface	
	Milestones	
	Vision, Mission and Mandate	
1.	Executive Summary	1
2.	Introduction	9
3.	Research Achievements	17
4.	Technology Assessed and Transferred	59
5.	Education and Training	61
6.	Awards	81
7.	Linkages and Collaborations in India and Abroad including Outside Funded Projects	89
8.	List of Publications	93
9.	Consultancy and Advisory Services	107
10.	RAC, Management Committee and IRC	111
11.	Papers Presented and Participation of the Institute at the Conferences/ Workshops, etc.	117
12.	Conferences, Workshops, Meetings, Seminars and Annual Day Organized	129
13.	Distinguished Visitors	135
	Annexures	
	I. List of Research Projects	137
	II. ICAR-IASRI Personnel	145
	III. Various Committees	146
	IV. National Agricultural Science Museum (NASM)	150
	V. Results-Framework Document (RFD) for ICAR-Indian Agricultural Statistics Research Institute (2014-2015)	152
	VI. Annual (April 1, 2014 to March 31, 2015) Performance Evaluation Report in respect of RFD 2014-2015	158

Advisors / Directors

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

Vision

Statistics and Informatics for enriching the quality of Agricultural Research

Mission

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

Mandate

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

Preface

It is a matter of immense pleasure and great satisfaction to present the Annual Report 2015-16 of ICAR-Indian Agricultural Statistics Research Institute (ICAR-IASRI), an ISO 9001:2008 certified Institute of Indian Council of Agricultural Research (ICAR) with glorious tradition of carrying out research, teaching and training in the area of Agricultural Statistics and Informatics.

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

This report highlights the research achievements made, new methodologies developed, significant advisory and consultancy services provided, dissemination of knowledge acquired and human resource development. The scientists, technical personnel, administrative, finance and other staff of the Institute have put in their best efforts in fulfilling the mandate of the Institute. During the year, research was carried out under 84 research projects (41 Institute funded, 37 externally funded, 1 National Professor Scheme, 1 National Fellow Scheme and 4 Consultancy Projects) in various thrust areas. Out of these, 37 projects were in collaboration with other Institutes, 16 projects were completed, 01 project was declared closed and 33 new projects were initiated.

A landmark for the institute this year is that ICAR-IASRI has been declared as National Level Agency (NLA) under MIDH (Mission for Integrated Development of Horticulture). KRISHI (Knowledge based Resources Information Systems Hub for Innovations in agriculture) portal (http://krishi.icar.gov.in/) has been launched as a centralized data repository system of ICAR. ICAR Data Centre established at ICAR-IASRI acquired the certification for ISO/IEC 20000 and ISO/IEC 27001 for IT- service management and information security legislation respectively.

The Institute has made its presence felt in the National Agricultural Research and Education System (NARES) through its research and human resource development programmes. The Institute has contributed significantly by providing excellent human resource to NARES in the disciplines of Agricultural Statistics and Informatics. During the year, 24 training programmes (four under Centre of Advanced Faculty Training, eight Resource Generation training programs, and twelve other training programmes sponsored by Education Division, ICAR; PG School, IARI, New Delhi and the Institute) were organized in which 532 participants were imparted training. During the year, a total of 24 students {3 Ph.D. (Agricultural Statistics), 8 M.Sc. (Agricultural Statistics), 8 M.Sc. (Computer Application) and 5 M.Sc. (Bioinformatics)} completed their degrees. 32 students {9 Ph.D. (Agricultural Statistics), 7 M.Sc. (Agricultural Statistics), 4 Ph.D. (Computer Application), 5 M.Sc. (Computer Application), 3 Ph.D. (Bioinformatics) and 4 M.Sc. (Bioinformatics)} were admitted. A Senior Certificate Course in Agricultural Statistics and Computing was also organized.

The Institute has made important contributions in strengthening National Agricultural Statistics System (NASS), which has a direct impact on the national policies. The Institute has published 139 research papers in National and International refereed Journals along with 27 popular articles/short communications, 1 pocket diary, 2 books, 39 book chapters, 4 papers in conference proceedings and 46 project reports/ technical bulletins/monograph/reference manuals/brochures. Besides, 13 Workshop documents/ database/e-manuals/e-resources/e-learning portal were also developed.

I am extremely happy to share that some of our colleagues received academic distinctions during the year. Dr. Hukum Chandra received National Award in Statistics 2014-15 from the Ministry of Statistics and Programme Implementation, Government of India; Dr. Seema Jaggi received the INSA Teacher Award 2015; Dr. Alka Arora received Active participation Award Women Member 2014-15; Dr. AR Rao was awarded NAAS-Fellowship. Dr.Sarika received the Distinguished Scientist Award; Dr. MA Iquebal received Young Scientist Award; Dr. Ranjit Kumar Paul received Young Scientist Award; Dr. Sarika and Dr. MA Iquebal received Team Award; Dr. Arpan Bhowmik received Dr. GR Seth Memorial Young Scientist Award; Dr. Dinesh Kumar received Distinguished Scientist Award and Gold Medal with Certificate of Academic Excellence and Dr. Eldho Varghese and Dr. Arpan Bhowmik were awarded with Krishi Vigyan Gaurav Honorary Title. Smt. Suman Khanna received ICAR Cash Award/Certificate of Distinction 2014 under Administrative Category.

This year, scientists were deputed on different assignments to Rome, Italy; Jakarta, Indonesia; Kigali, Rwanda; Kingston, Jamaica; Sri Lanka; Daejeon, Republic of Korea and Rio De Janeiro, Brazil. Three seminars were delivered by Guest Speakers namely Prof. Bikash Sinha, Former Member, National Statistics Commission and Professor, Indian Statistical Institute, Kolkata; Dr. Dulal K. Bhowmick, Director, BRC, University of Illinois, USA; Dr. Balgobin Nandram, Professor of Statistics, Worcester Polytechnic Institute, USA.

I would like to express my gratitude to Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR) and Dr. S Ayyappan, Former-Secretary (DARE) & DG (ICAR) for their invaluable guidance, encouragement and support. I am grateful to Dr. K. Algusundaram, DDG (Engg.), ICAR, New Delhi and Dr. Kanchan K Singh, ADG (FE), ICAR, New Delhi for his constant direction, inspiration and backing. My sincere appreciation are to all Heads of Divisions, scientists and other staff of the Institute for their devotion, whole-hearted support and cooperation in carrying out various functions and activities of the Institute. The services of the PME Cell in compiling and timely publication of the report are highly appreciated. I wish to express my sincere thanks to all my colleagues in PME Cell, in particular the In-charge, Dr. Ajit for all the efforts and coordinating various activities.

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

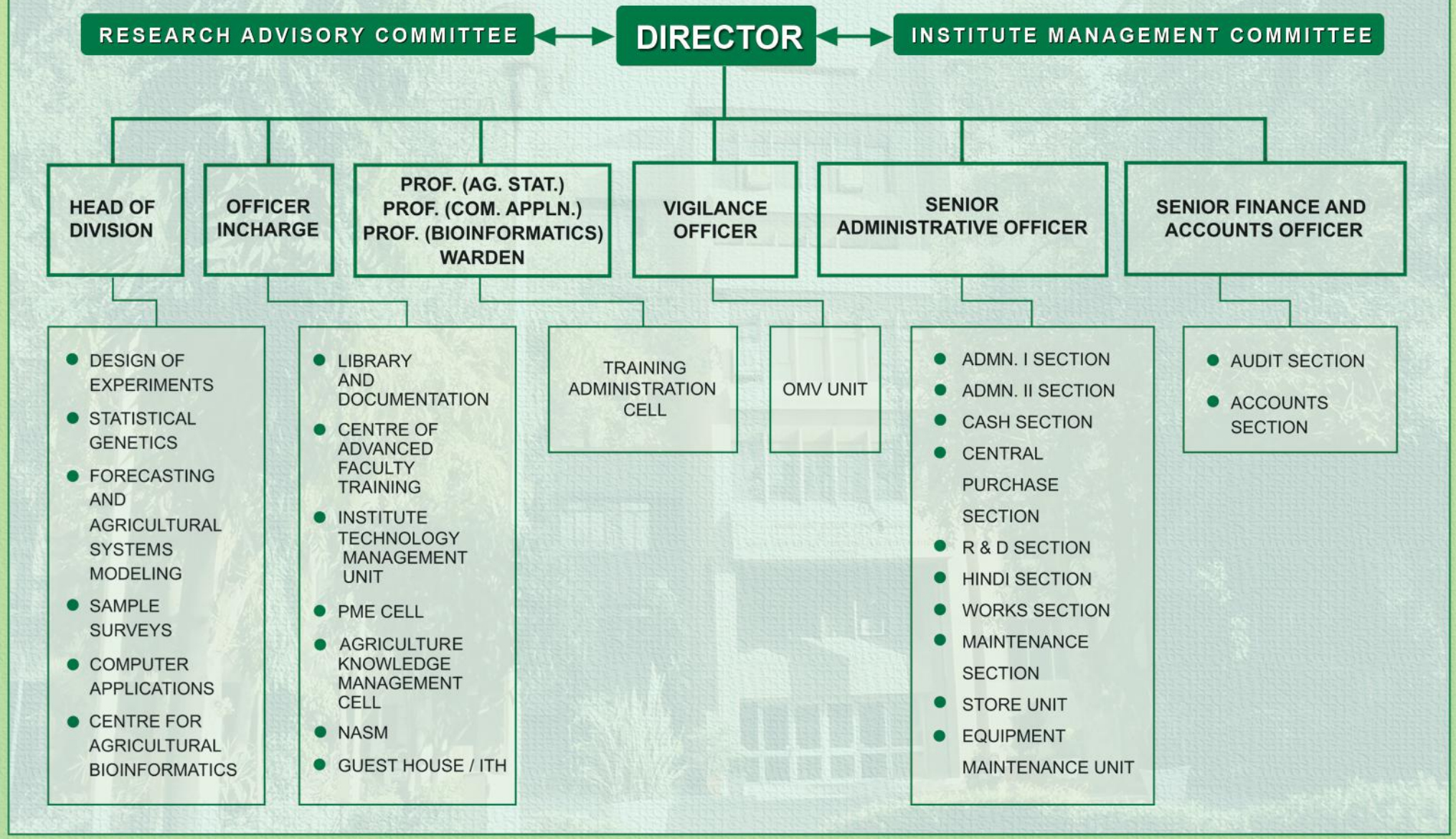
(UC Sud)
Director

Milestones

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

	• First indigenously developed software on windows platform Statistical Package for Factorial Experiments (SPFE) 1.0 released
2004	• National Information System on Agricultural Education (NISAGENET) Project launched
	• Training Programme for private sector initiated and conducted training programme for E.I. DuPont India Private Limited
	• E-Library Services initiated
2005	• Statistical Package for Augmented Designs (SPAD) and Statistical Package for Agricultural Research (SPAR) 2.0 released
	• Design Resources Server with an aim to provide E-advisory in NARS initiated
2006	• Organisation of International Conference on Statistics and Informatics in Agricultural Research
2007	• Establishment of Agricultural Bioinformatics Laboratory (ABL)
2008	• Software for Survey Data Analysis (SSDA) 1.0 released
2009	• Golden Jubilee Celebration Year of the Institute
	• Strengthening Statistical Computing for NARS initiated
	• Expert System on Wheat Crop Management launched
	• International Training Hostel inaugurated
2010	• Establishment of National Agricultural Bioinformatics Grid (NABG) in ICAR initiated
	• Division of Biometrics re-named as Division of Biometrics and Statistical Modelling
	• Division of Forecasting Techniques and Division of Econometrics merged to form Division of Forecasting and Econometrics Techniques
	• A new centre namely Centre for Agricultural Bioinformatics [CABin] created
2011	• Maize AgriDaksh and Expert System on Seed Spices launched
	• Indian NARS Statistical Computing Portal initiated
	• M.Sc. degree in Bioinformatics initiated
2012	• Software for Survey Data Analysis (SSDA) 2.0 released
	• Division of Biometrics and Statistical Modelling re-named as Division of Statistical Genetics
	• Division of Forecasting & Econometrics Techniques re-named as Division of Forecasting & Agricultural System Modeling
	• Development of Management Information System (MIS) including Financial Management System (FMS) in ICAR initiated
	• Half-Yearly Progress Monitoring (HYPM) System in ICAR implemented
	• Sample Survey Resources Server initiated
2013	• High Performance Computing (HPC) System for Biological Computing established
	• Ph.D. degree in Computer Application initiated
	• Certified as ISO 9001:2008 (Quality Management System) Institute
2014	• Advanced Supercomputing Hub for OMICS Knowledge in Agriculture (ASHOKA) inaugurated
	• ICAR-ERP system implemented
	• Ph.D. degree in Bioinformatics initiated
	• IASRI Campus Wi-Fi enabled
	• ICAR Data Centre, Unified Communication and Web Hosting Services for ICAR started
	• FAO Sponsored Study under the Global Strategy for Improvement of Agricultural Statistics initiated
2015	• KRISHI (http://krishi.icar.gov.in/) Knowledge based Resources Information Systems Hub for Innovations in agriculture portal has been launched as a centralized data repository system of ICAR.
	• ICAR-IASRI has been declared as National Level Agency (NLA) under MIDH (Mission for Integrated Development of Horticulture).
	• ICAR Data Centre established at IASRI acquired the certification for ISO/IEC 20000 and ISO/IEC 27001 for IT-service management and information security legislation respectively.

ORGANOGRAM


RESEARCH ADVISORY COMMITTEE
DIRECTOR
INSTITUTE MANAGEMENT COMMITTEE
HEAD OF DIVISION
OFFICER INCHARGE
PROF. (AG. STAT.)
PROF. (COM. APPLN.)
PROF. (BIOINFORMATICS)
WARDEN
VIGILANCE OFFICER
SENIOR ADMINISTRATIVE OFFICER
SENIOR FINANCE AND ACCOUNTS OFFICER
DESIGN OF EXPERIMENTS
STATISTICAL GENETICS
FORECASTING AND AGRICULTURAL SYSTEMS MODELING
SAMPLE SURVEYS
COMPUTER APPLICATIONS
CENTRE FOR AGRICULTURAL BIOINFORMATICS
LIBRARY AND DOCUMENTATION
CENTRE OF ADVANCED FACULTY TRAINING
INSTITUTE TECHNOLOGY MANAGEMENT UNIT
PME CELL
AGRICULTURE KNOWLEDGE MANAGEMENT CELL
NASM
GUEST HOUSE / ITH
TRAINING ADMINISTRATION CELL
OMV UNIT
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
AUDIT SECTION
ACCOUNTS SECTION

Executive Summary

ICAR-Indian Agricultural Statistics Research Institute (ICAR-IASRI) an ISO 9001:2008 certified Institute, is mainly responsible for conducting research and education in Agricultural Statistics and Informatics to bridge the gaps in the existing knowledge. The Institute has used the power of Statistics blended judiciously with Informatics and has contributed significantly in improving the quality of Agricultural Research. The Institute has also been providing education/ training in Agricultural Statistics and Informatics to develop trained manpower in the country. The research and education is used in improving the quality and meeting the challenges of agricultural research in newer emerging areas. The entire campus is Wi-Fi enabled with a high speed internet connection. A landmark for the institute this year is that ICAR-IASRI has been declared as National Level Agency (NLA) under MIDH (Mission for Integrated Development of Horticulture). KRISHI (http://krishi.icar.gov.in/) Knowledge based Resources Information Systems Hub for Innovations in agriculture portal has been launched as a centralized data repository system of ICAR. ICAR Data Centre established at ICAR-IASRI acquired the certification for ISO/IEC 20000 and ISO/IEC 27001 for IT- service management and information security legislation respectively.

The Institute has made some outstanding and useful contributions to research in Agricultural Statistics and Informatics. A number of research projects were undertaken in the Institute during this year. Research was carried out under 84 research projects (41 Institute funded, 37 externally funded, 1 National Professor Scheme, 1 National Fellow Scheme and 4 Consultancy Projects) in various thrust areas. Out of these, 37 projects were in collaboration with other Institutes, 16 projects were completed, 01 project was declared closed and 33 new projects were initiated.

Some salient research achievements are as follows:

- A series of row-column designs partially balanced for adjacent directional spatial indirect effects (neighbour effects) upto order two in four directions has been obtained for even number of treatments with parameters v, $p = v$, $q = v$ and $m = 1$. A series of experimental designs balanced for spatial and temporal indirect effects of treatments has been constructed.
- Developed module named webFMC (http://webfmc.iasri.res.in.) to generate any combination of symmetric and asymmetric factorial design with minimally changed run sequences.
- Using SAS Macros, a method was developed for obtaining Box-Behnken Design with minimum level changes in the run sequences. General expression for factor-wise change as well as the total change of minimal Box-Behnken Design was derived.
- Developed and implemented an algorithm in R programming language to construct A-optimal balanced treatment incomplete block designs for given parametric combinations. The developed algorithm has been utilized to construct A-optimal BTIB designs in the parametric range of number of test treatments less than or equal to 30, number of blocks less than or equal to 50 and block size less than or equal to 10. An algorithm is developed to obtain A-optimal Group Divisible Treatment (GDT) Designs for comparing several test treatments with a control treatment.

- ICAR Research Data Repository for Knowledge Management called KRISHI (Knowledge based Resources Information Systems Hub for Innovations) portal (http://www.krishi.icar.gov.in) in agriculture has been launched as a centralized data repository system of ICAR consisting of Technology and Data.
- Indian NARS Satistical Computing Portal is being extensively used throughout NARES and helped the researchers in analyzing their data in an effective manner. Based on the user logged information, the total number of logged in users from Indian NARES during April 01, 2015 - March 31, 2016 are 87,392 which is on an average more than 235 logged in per day.
- A method for construction of first order and second order orthogonal Latin hypercube designs with 3, 4 and 6 factors in any possible number of runs have been developed.
- Strengthened Design Resources Server (www.iasri.res.in/design) by adding the links on (i) Online generation of Balanced Incomplete Latin square BILS (v, r) designs for all values of $3 < v < 21$ (except v = 6, 10, 14, 18) at www.iasri.res.in/design/BILS_Design/Default.aspx (ii) Online generation of Row Column Designs with equal replication of each treatments for Factorial Experiments in Two Rows for 2n (n<10) factorial experiments for orthogonal estimation of main effects and two factor interactions (http://www.iasri.res.in/design/Row_Column_design_OP_2_rows/ Default.aspx). It also generates designs with unequal replications in the same parametric range for orthogonal estimation of main effects and two factor interactions. (iii) Bibliography on Response Surface Designs is also made available at http://www.iasri.res.in/design/Response%20Surface/RS_Home.html.
- During April 01, 2015 - March 31, 2016, Design Resources Sever has 11,561 page views through 466 cities of 102 countries through Google Analytics.
- For providing e-advisory and e-learning in sample surveys, Sample Survey Resources Server (http://sample.iasri.res.in/ssrs/) was strengthened by adding links on bibliography on Non-sampling errors; History of Statistics on Timeline and MAPI (Mobile Assisted Personal Interview) a mobile Application for Android OS.
- To develop composite indicators for agricultural livelihood, methodology has been developed using PCA for construction of Science Culture Index (SCI).
- A model is proposed that captures both the cyclicity as well as volatility phenomena and the methodology for fitting the model is developed. For the volatile datasets which has missing observation, the EM algorithm in conjunction with particle filter was applied to estimate the parameters of Stochastic Volatility (SV) model.
- Under the study on monthly wholesale prices of onion of Mumbai, Nashik, Delhi and Bangalore markets, R and MATLAB software have been used for analyzing the data. The methodology has been extended to the semiparametric approach in which Nadaraya-Watson estimation technique has been applied to obtain the estimator of semiparametric conditional covariance matrix. A new innovative approach using Radial Basis Function (RBF) neural network combined with genetic algorithm has been applied to understand the nature of volatility spillover among the onion markets.
- Under a study entiled Non-parametric Bootstrap Approach for Constructing Prediction Intervals for Non-Linear and Bivariate Time Series Models, one real data set was taken and fitted employing VAR model and the residuals of the fitted model was tested employing MVN test. Bootstrap algorithm for constructing prediction interval in VAR model has been developed. Out of sample forecasting code for ANN is developed in Matlab software.
- Under the FAO funded study, the sampling methodology for estimation of crop area and yield under mixed and continous cropping, has been developed for different situations prevailing in diffreent countries. This methodology is being field tested in three countries, one each in Asia-Pacific, Africa and Latin America/Caribbean region, i.e. Indonesia, Rwanda and Jamaica respectively. The questionnaires developed for primary data collection have been designed using CAPI designer. In-house server at ICAR-IASRI has been set up and configured for the CAPI software and the data from the field is being uploaded by the Enumerators/Field Investigators of Indonesia to the ICAR-IASRI server dedicated for this purpose.
- The ICAR-IASRI has been declared as National Level Agency (NLA) under MIDH for taking up a study to test the Developed

Alternative Methodology for Estimation of Area and Production of Horticultural Crops: IASRI Component of CHAMAN Project under Mission for Integrated Development of Horticulture (MIDH). Testing and validation of methodology for estimation of area and production of horticultural crops developed by ICAR-IASRI is being carried out in six states of the country.

- Under the pilot study "Developing State Level estimates of Crop Area and Production on the Basis of sample Sizes Recommended by Professor Vaidyanathan Committee Report", sampling methodology has been developed. Mobile Assisted Personal Interviewing (MAPI) software has been developed for the data collection. Implementation of MAPI software in Uttar Pradesh State has been initiated.
- The estimates of wastage ratios for seed, feed and total production in respect of major food grains viz. paddy, wheat, maize, bajra, jowar, ragi and barley has been computed. It indicates that over-all ratios have gone down by 4.5% approximately as compared to the ratios (12.5%) used since long for estimating the total availability of food grains for human consumption in the country. These ratios are of immense use for planning and formulation of future policies by the policy makers for the economic development of the country.
- Under two stage sampling design, with assumption that the auxiliary variable is inversely related to study variable, three different calibration approach based product type estimators for estimation of population total along with their approximate variance and the Yates-Grundy form of estimate of variance have been developed. Usual product estimators for estimation of population total under all cases in two stage sampling design were compared with the proposed calibration approach based product type estimator. On the basis of the correlation coefficient between study and auxiliary variable, criteria of superiority of the proposed calibration based product type estimators with respect to usual product estimators of population total have been obtained. Further, the variance and estimate of variance of the product type calibration estimators have been developed considering equal probability without replacement design (SRSWOR) at different stages and phases of sampling.
- Under a study, Development of Innovative Approaches for Small Area Estimation of Crop Yield, Socio-economic and Food Insecurity Parameter, a bias-corrected predictor for small area quantities under log transformed Fay Herriot model has been developed. The empirical results based on simulation studies show that the proposed predictor has smaller bias and better efficiency as compared to the alternative predictor.
- The process for Testing and Validation of Alternative Methodology Developed by ICAR-IASRI for Estimation of Area and Production of Horticultural Crops in Madhya Pradesh and Haryana States has been initiated.
- Regarding Robust and Efficient Small Area Estimation Methods for Agricultural and Socio-Economic Surveys and their Application in Indo-Gangetic Plain, geographically weighted regression concept is considered to extend the area level version of GLMM to take into account the spatial nonstationarity and then to use it in small area estimation. The proposed NSEP provides efficient estimates for small areas as compared to existing methods when spatial nonstationarity is present in the data. Proposed small area estimation method is also applied to obtain reliable estimates of proportion of poor households at district level in the State of Uttar Pradesh. Subsequently, a poverty map for State of Uttar Pradesh is produced which provides important information for analysis of spatial distribution of poverty in the State.
- An operating manual entitled “Operating Manual for implementation of alternative sampling methodology for estimation of cotton production using double sampling approach” for implementation of the newly developed methodology in cotton growing states of the country was prepared. The official estimates of cotton production from 2015-2016 may be released using the newly developed alternative methodology.
- Agricultural Research Data Book (ARDB) 2015, which is the eighteenth in the series, has been published.
- In the study Modelling and Forecasting of Time-Series with Long Memory Processes, it is found that both the returns as well as squared return spot price series data are stationary. By applying the GPH tests for testing long memory to the

return and squared returns of the spot prices of gram, it was observed that for the return series, the test showed no evidence of LM patterns; as the null hypothesis of no persistence was not rejected. The result for squared return was different from that of the returns. Indeed, long memory property was found to be highly significant for the squared returns.

- Four web servers viz., *dSSpred* (http://cabgrid.res.in:8080/sspred), *PreDOSS* (http://cabgrid.res.in:8080/predoss), *HSplice* (http://cabgrid.res.in:8080/hsplice) and MalDOSS (http://cabgrid.res.in:8080/maldoss) have been developed for the prediction of donor splice sites. The developed web servers will be of great help for the biological community for easy prediction of donor splice sites.
- The stability measure based on rank for selecting stable genotype has been developed by using rank sum (RS) of different genotype on the basis of rank of absolute interaction residual and variance of each genotype among the environment on the basis of interaction residual among all environments. Linear combination of stability ranks realized from RS and $S_i^{(2)}$ is proposed as a new stability measure and is denoted as rank based stability index RSI=(r_{RS}+ $r_{Si(2)}$)/2, where r_{RS} is stability rank based on rank sum measure and $r_{Si(2)}$ is stability rank based on variance.
- An attempt has been made to reparametrize the autoregressive coefficient to ensure the stationarity in the data. The additive genetic variance covariance matrix has been constructed and the estimates of fixed and random effects and their variances have also been derived. The computer program has been developed to calculate the numerator relationship matrix and for estimation of variance components in Linear Mixed effect Model (LMM) in presence of both correlated random effects and error.
- For the selection of informative genes under particular stress condition, a gene selection technique has been proposed based on bootstrapping and support vector machine with recursive feature elimination (SVM-RFE). The gene ontology enrichment analysis of the selected genes revealed the underlying cellular mechanism of Al stress response in soybean. For the identification of hub genes (highly interacting genes) in the genetic network, a resampling based technique was proposed. The performance of the proposed technique was compared with the existing technique and the results showed that former identified a less number of hubs as compared to latter, which are in accordance with the scale free property of biological networks. For rice and soybean crops, various hub genes and unique hub genes were also identified.
- Gene expression data of Arabidopsis and Rice for different stresses *viz.* bacteria, salinity, cold and drought was collected from NCBI GEO database. The raw data was pre-processed using RMA algorithm. A gene selection approach, Boot-MRMR was proposed by incorporating bootstrap in MRMR procedure.
- SAS codes for data generation as well as heritability estimation for different correlation structure of errors (AR(1) and AR(2)) in case of half sib and full sib models have been developed. It is noticed that in the presence of fixed effect, MSE values increases for increasing correlation value and decreases with increase in sample size.
- A unidirectional causality has been observed between gross domestic product (GDP) and agricultural exports. This indicates that growth in agricultural exports has contributed to the overall and agricultural growth in India. This study has suggested that Indian trade policy environment needs to be made more favourable for attracting foreign buyers and making Indian exports competitive globally.
- Propensity Score Matching (PSM) method has been used to estimate the average treatment effect of crop insurance on farm output. Probit model has been employed to estimate the propensity scores. Most of the insured farmers were found among the borrowers who had borrowed credits from bank. The impact of insurance on farm output was found positive and highly significant. Therefore, there is need to enhance the flow of crop insurance to reduce or cover the risk factor in the production practices. An attempt is also being made to compute Total Factor Productivity (TFP) at district level in India using stochastic production function in panel data.
- Literature survey of iterative and analytical solution of stochastic differential equations

(SDE) has been carried out. It has been found that conditional distribution of solution of SDE with additive noise is Gaussian whose conditional distribution is homogeneous. Attempt has been made to obtain linear SDE with non-homogeneous transition probabilities.

- Genes and promoters which are common across genotypes under specific stress, can serve as robust candidates for crop improvement. Metadata analysis of rice R genes from 11 different Oryza species has been standardized.
- In order to identify regulatory elements, miRNAs in buffalo has been identified using *in-silico* approach. Total six miRNAs and their target genes along with their structure have been identified based on Expressed Sequence Tag (EST) data.
- The novel-heat stress responsive genes have been identified, transcriptome data analysis has been done. This will be useful for understanding of stem reserve mobilization, photosynthetic heat tolerance and heat tolerance in grain development. The heat responsive candidate gene based SSR markers have also been identified which may be useful in mapping QTLs for heat stress tolerance in wheat.
- A database of coreset germplasm of 375 wheat coreset varieties and 192 AVT (Advance Varietial Trial) along with 38 DUS feature data has been developed. Also for SNP based variety differentiation, SNP data has been generated using 35K aflymatrix chip.
- Availability of whole genome sequence and *in silico* approaches has revolutionised the bulk marker discovery. The world's first wheat whole genome marker discovery and database, WHMDb (http://webapp.cabgrid.res.in/whmdb/) with 476K markers unified in a common platform using MySQL, Apache and PHP has been reported. The embedded markers and corresponding location information can be selected on desired chromosome and location/ interval based primers can be generated using Primer3 core, integrated at the backend. A miRNA prediction tool using wheat coding sequence has been developed. The target of these miRNA can also be predicted.
- First whole genome putative microsatellite DNA marker database (http://webapp.cabgrid.res.in/sbmdb/) of sugarbeet for bioenergy and industrial applications has been developed. It was listed as one of the Salient Achievements for the year 2015 of Indian Council of Agricultural Research.
- The transcriptome profile of two fish species i.e. *Labeo rohita* and *Labeo bata* has been done through experiment to understand the higher utilization of glucose in *Labeo bata*.
- A legume viral database has been developed. Public domain databases were used to mine viral sequences. A total of 2574 viral sequence of legume crop has been mined which were having 1835 partial, 737 full genome and 2 genomic RNA to create database of legume virus. It was found that among 2574 genes, 515 genes are reported from India and rest 2059 from other countries.
- For whole genome sequencing of Rohu fish, data were generated using three chemistry *viz*. Roche 454 GS FLX (4.45 GB, 8 runs), IonTorrent (0.83 GB, single run) and Illumina (Miseq 67.98 GB and Nextseq: 142.5 GB). For genomic resources/marker discovery, a total of 512916 SSRs were mined from draft assembled genome and a database is created. For whole genome sequencing of Magur fish, data were generated using three chemistry *viz*. Roche 454 GS FLX (2.47 GB, 4 runs), IonTorrent (0.64 GB, single run) and Illumina (Miseq and Hiseq: 453.88 GB). Using CLC Genomics workbench software, *de novo* assembly has been completed. In order to achieve objective of genomic resources/marker discovery, a total of 702739 SSRs were mined from draft assembled genome and a database has been developed.
- Hormone Regulatory Relationship between TF's and their Target under Combined Salt, Drought and Heat stress has been studied. This provides an insight into hidden crosstalk's and the influence of three hormones i.e. ABA, GA and Auxin, under combined drought and salt stress within plant. It was observed that this hormone governing network has particular topological properties in transcriptional regulatory networks and relates to certain regulatory mechanisms in gene regulation.
- A user-friendly, menu driven, interactive and web-based database named as CerealESTDb has been developed. This database contains assembled and annotated ESTs of rice, wheat, sorghum and maize induced under cold, heat,

drought, salinity stress as well as on application of ABA. This will also provide information about genes, ontology and corresponding pathways related to these ESTs.

- An efficient algorithm has been developed for comparing protein structure using Elastic Shape Analysis (ESA) in which the sequence of 3D coordinates of atoms of protein structures has been used as parameterised curve supplemented by addition of auxiliary information based on side-chain properties.
- The graph theory based approach has been proposed to compare the protein 3-D structures. The proposed algorithm has been implemented in MATLAB. MATLAB programs have been written for reading PDB files, selecting model and chain in the given PDB files, building graph adjutancy and distance matrix, partitioning of the graph using spectral & MCL clustering techniques, building binary 2D structure matrix and superimposing the matrices.
- For Development of 16s rDNA Rumen Microbes Specific Database, Phylogenetic tree has been generated with selected microbes sequence data. The database has been developed. BLAST database has also been created to search microbes by sequence. BLAST database has been placed at the shared folder in the ASHOKA cluster.
- In order to resolve mango genome assembly issues due to highly heterozygous genome of Amarpali, PacBio based NGS data with longer read lengths of >3.5 kb using P4C2 and P5C3 chemistries with 70Xgenome coverage were generated. This is World's first Mango Genome Draft assembly of *Network Project on Transgenics in crops.*
- The reports under project entitled. National Information System on Agricultural Education Network (NISAGENET) have been made accessible to Google Chrome as well as Mozilla Firefox Browsers. A mobile app for accessing NISAGENET reports has been developed and is made accessible from NISAGENET website.
- Academic Management System CIFE (AMS-CIFE), a web enabled system and second system in line with Management System: PG School ICAR-IARI has been launched. The system will enhance the overall efficiency of the academic system and facilitate e-learning for the students. It is accessible online at http://amscife.icar.gov.in from ICAR Data Center at ICAR-IASRI.
- An online knowledge base system for disease identification in tobacco (Tobacco Agridaksh) has been developed using Agridaksh tool to provide global accessing of all information on various diseases of tobacco and their symptoms. This system is useful to enhance the efficiency of farmers, agricultural extension personnel, development agencies for crop management and to increase the crop yield. It determines the best strategy for disease management, identification and diagnosis.
- Implementation of ICAR-ERP solution was completed in all 109 Institutes (ICAR Headquarter, ASRB, Institutes-99, and ZPDs-8) and knowledge enhancement sessions on ICAR-ERP were organized. To facilitate the trainings, User Manuals, Short Manuals related to Process and Video Tutorials have been developed and made available on the project web site (http://www.iasri.res.in/misfms). Policy/ Process has been designed for creation of e-mail id and hosting of websites/applications.
- A software has been developed for analysis & monitoring of storage losses in food grains. The software is to facilitate reporting of data collected from godowns for four commodities at the periodic level starting from storage to liquidation based on moisture parameters recorded on sample taken from the stack, weather conditions, infestation status etc. This is standalone software to be used by the identified 20 AICRP-PHT Centres and has the feature of export utility to send the updated data to AICRP-PHT Ludhiana. It also has an import utility to import the data in central database for further analysis.
- Phenomics computation facility has been created for storing the image data, developing the models for analysis of the image data, hosting the solutions developed. It allows users to store experiment data files (digital images, pdf, excel, doc file etc.) online with corresponding meta-data and share data collections with the user community. The GUI of Multimedia Data Management System has been strengthened with additional reports. A Non-destructive approach for Leaf Area estimation through image analysis has been developed. This help users in finding out the leaf area of a rice plant in pot condition by uploading its photograph on

the online system. A mobile application for this purpose is also developed to enable user in uploading photographs from mobile as per the instructions and estimating leaf area.

- The Expert System on Dog Health (ESDH) has been developed. It provides symptom based diagnosis of 48 dog diseases. The database was created using IndexedDB and modules were developed using JSON, CSS3 and Javascript.
- An efficient methodology has been developed for comparing protein structure using Elastic Shape Analysis (ESA) in which the sequence of 3D coordinates atoms of protein structures has been used as parameterised curve which is supplemented by addition of auxiliary information based on side-chain properties. This curve is represented by a special function called Square Root Velocity Function (SRVF). Source codes for different functions have been developed in R. Also, user friendly web-based application called ProtSComp has been developed using Algorithm for Protein Structure Comparison that can be accessed freely by the users.

The Institute has regularly organized the meetings of Research Advisory Committee (RAC), Institute Management Committee (IMC) and Institute Research Committee (IRC).

Scientists of the Institute have published 139 research papers in National and International refereed Journals along with 27 popular articles/ short communications, 1 pocket diary, 2 books, 39 book chapters, 4 papers in conference proceedings and 46 project reports/technical bulletins/ monograph/reference manuals/brochures. Besides, 13 Workshop documents/ database/e-manuals/e-resources/e-learning portal were also developed.

During the year, 24 training programmes were organized in which 532 participants were imparted training. Breif account of the trainings organised is as below.

- Four 21 days training programme under Centre of Advanced Faculty Training (CAFT) were organised on Application of Computer Algorithms and Statistical Software Packages in Agriculture; Advances for Technological Enhancement in Agricultural Research; Computational Tools and Techniques for Molecular Data Analysis in Agriculture; and Recent Advances in Statistical Genetics and Genomics.
- Eight Resource Generation training programs were conducted on Integrated Sample Survey Methodology; Sample Survey and Sampling Design; Data Analysis and Interpretation; Field Data Collection under the Study "Improving Methods for Estimating Crop Area, Yield and Production under Mixed, Repeated and Continuous Cropping"; Crop Cutting Experiments Technique; Use of Models in Crop Yield Estimation and Small Area Estimation Techniques and Applications sponsored by Ministry of Agriculture, Government of India; DES, Deptt. of Planning, Govt. of UP; MoSPI, Govt. of India; FAO; Skymet Weather Sevices Private Ltd., Noida; and three by NSSTA, CSO, MOS&PI, GOI, New Delhi.
- Twelve other training programmes, one sponsored by Education Division, ICAR on Designing and Analysis of Experiments for the Technical Personnel of ICAR; one by PG School, IARI, New Delhi on Experimental Data Analysis for Ph.D. Students from various disciplines of PG School, IARI and ten project based programs by the Institute were organized.

The activities relating to Post Graduate teaching programmes of the Institute were undertaken in collaboration with PG School, ICAR-IARI. During the year, a total of 24 students {3 Ph.D. (Agricultural Statistics), 8 M.Sc. (Agricultural Statistics), 8 M.Sc. (Computer Application) and 5 M.Sc. (Bioinformatics)} completed their degrees. 32 students {9 Ph.D. (Agricultural Statistics), 7 M.Sc. (Agricultural Statistics), 4 Ph.D. (Computer Application), 5 M.Sc. (Computer Application), 3 Ph.D. (Bioinformatics) and 4 M.Sc. (Bioinformatics)} were admitted. A Senior Certificate Course in Agricultural Statistics and Computing was also organized.

Dr. UC Sud and Dr. Tauqueer Ahmad visited FAO, Rome to attend Expert meeting on Improving methods for estimating area, yield and production under mixed and continuous cropping and Improving methods on estimating post harvest losses held at Food and Agriculture Organization (FAO) Headquarter, Rome, Italy; Jakarta, Indonesia; NISR, Kigali, Rwanda and Kingston, Jamaica as Resource Person for imparting training to enumerators and supervisors for primary data collection and to supervise live data collection under the project “Research on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping”. Dr. Hukum Chandra visited Sri Lanka as International Consultant, for short term FAO consultancy under Global Strategy to Improve Agricultural and Rural Statistics in Sri Lanka; Daejeon, Republic of Korea for attending the Regional Workshop on “Statistical

Literacy"; Rio De Janeiro, Brazil to attend the 60th International Statistics Institute World Statistics Congress 2015 as Invited speaker; Japan to attend Regional Workshop on Training of Trainers for Official Statistics and Second Expert Group Meeting of the Network for the Coordination of Statistical Training in Asia and the Pacific. Dr. Hukum Chandra and Dr. Man Singh visited Jakarta, Indonesia for supervision of data collection work under the Food and Agriculture Organization of United Nations funded project entitled "Research on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping".

Four seminars were delivered by Guest Speakers Prof. Bikash Sinha, Former Member National Statistical Commission and Professor, Indian Statistical Institute, Kolkata on Into the mysterious world of p the bernoulli parameter; Dr. Dulal K. Bhowmick, Director, BRC, University of Illinois, USA on Statistical methodologies in neuro-connectivity analysis using fMRI data in autism; Dr. Balgobin Nandram, Professor of Statistics, Worcester Polytechnic Institute, USA on "My association with USDA's NASS" and SPSS Team on "Demonstration on SPSS software along with SPSS Online Training for Govt. Officials". One seminar was delivered by Vigilance Officer of the Institute.

Scientists of the Institute have brought laurels to the Institute by receiving awards from different agencies. Dr. Hukum Chandra received National Award in Statistics 2014-15 from the Ministry of Statistics and Programme Implementation, Government of India. Dr. Seema Jaggi received the INSA Teacher Award 2015; Dr. A.R. Rao was awarded NAAS-fellowship; Dr. Alka Arora received Active participation Award Women Member 2014-15 from Computer Society of India; Dr.Sarika received the Distinguished Scientist Award in recognition of her meritorious and outstanding scientific contribution in the field of Bioinformatics; Dr. MA Iquebal received Individual Award as Young Scientist Award in recognition of his outstanding scientific contribution in the field of Bioinformatics. Dr. Ranjit Kumar Paul and Dr. MA Iquebal received Young Scientist Award of the Society for Application of Statistics in Agriculture and Allied Sciences (SASAA). Dr. Sarika and Dr. MA Iquebal received Team Award. Dr. Arpan Bhowmik received Dr. GR Seth Memorial Young Scientist Award. Dr. Dinesh Kumar received the Distinguished Scientist Award of the Society for Bioinformatics and Biological Sciences. Dr. Eldho Varghese and Dr. Arpan Bhowmik were awarded Krishi Vigyan Gaurav Honorary Title. Smt. Suman Khanna received ICAR Cash Award/Certificate of Distinction 2014 for Administrative Category.

Introduction

ICAR-Indian Agricultural Statistics Research Institute (IASRI) is a pioneer Institute of Indian Council of Agricultural Research (ICAR) undertaking research, teaching and training in Agricultural Statistics, Computer Application and Bioinformatics. Ever since its inception way back in 1930, as small Statistical Section of the then Imperial Council of Agricultural Research, the Institute has grown in stature and made its presence felt both nationally and internationally. ICAR-IASRI has been mainly responsible for conducting research in Agricultural Statistics and Informatics to bridge the gaps in the existing knowledge. It has also been providing education/ training in Agricultural Statistics and Informatics to develop trained manpower in the country. The research and education is used in improving the quality and meeting the challenges of agricultural research in newer emerging areas. The Institute has been awarded an ISO 9001:2008 certificate in the year 2013. ICAR Data Centre established at ICAR-IASRI acquired the certification for ISO/IEC 20000 & ISO/IEC 27001 in October, 2015.

ICAR Data Centre has been continuously providing the Unified Communication (Email, Audio, Video, Web conference etc.) and Webhosting service to ICAR and its Institutes.

The Institute has used the power of Statistics, as a science, blended judiciously with Informatics and has contributed significantly in improving the quality of Agricultural Research. To convert this vision into a reality, the Institute has set for itself a mission to undertake research, teaching and training in Agricultural Statistics and Informatics so that these efforts culminate into improved quality of agricultural research and also meet the challenges of agricultural research in newer emerging areas. The present main thrust of the Institute is to conduct basic, applied, adaptive, strategic and anticipatory research in Agricultural Statistics and Informatics, to develop trained manpower and to disseminate knowledge and information produced so as to meet the methodological challenges of agricultural research in the country.

The Institute has made its presence felt in the National Agricultural Research and Education System (NARES). The Institute feels proud to have established the first supercomputing hub for Indian Agriculture, ASHOKA (Advanced Super-computing Hub for OMICS Knowledge in Agriculture). Linkages have been established with all National Agricultural Research organizations for strengthening statistical computing. For providing service oriented computing for the users, Indian NARS Statistical Computing portal has been developed. Appropriate statistical techniques have been developed and recommended to researchers through advisory services. The Institute is also becoming progressively a repository of information on agricultural research data with the establishment of a Data Centre. The Institute also occupies a place of pride in the National Agricultural Statistics System (NASS) and has made several important contributions in strengthening NASS, which has a direct impact on the national policies. The Institute has contributed significantly by providing excellent human resource to NARES in the country in the disciplines of Agricultural Statistics and Informatics for meeting the challenges of Agricultural Research in the newer emerging areas. Conducting post graduate teaching and in-service courses in Agricultural Statistics, Computer Application and Bioinformatics for human resource development is an important activity.

The Institute has made some outstanding and useful contributions to research in Agricultural Statistics in the fields like Design of Experiments, Statistical

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

Significant Research Achievements

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

Design of Experiments

The Institute has made many notable contributions in both basic research and innovative applications of the theory of statistical designs and analysis of experimental data. Some of the areas are:

- Designs for single factor experiments which include variance balanced, efficiency balanced, and partially efficiency balanced designs; designs for tests versus control(s) comparisons; designs for multi-response experiments; crossover designs; designs with nested structures; neighbour balanced designs; optimality and robustness aspects of designs.
- Designs for multi-factor experiments which include confounded designs for symmetrical and asymmetrical factorials; block designs with factorial structure; response surface designs, mixture experiments for single and multifactor experiments; orthogonal main effect plans; orthogonal arrays; supersaturated designs.
- Designs for bioassays; designs for microarray experiments and designs for agroforestry experiments.
- Diagnostics in designed field experiments.
- Computer aided construction of efficient designs for various experimental settings; etc.
- For dissemination and e-advisory on designed experiments, developed a Design Resources Server (www.iasri.res.in/design) which is being viewed throughout the globe and used extensively in NARES.
- Web solutions for generation of experimental designs and online analysis of experimental data for different experimental settings.
- The scientists of the Institute participate actively in planning and designing of experiments in the NARES and have also involved themselves in the analysis of experimental data.
- Basic research work carried out on balanced incomplete block designs, partially balanced incomplete block designs, group divisible designs, α-designs, reinforced α-designs, square and rectangular designs, nested designs, augmented designs, extended group divisible designs, factorial experiments, response surface designs, experiments with mixtures etc. have been adopted widely by the experimenters in NARES.
- Designs for factorial experiments such as response surface designs and experiments with mixtures have been used for food processing and value addition experiments; soil test crop response correlation experiments; experiments with fixed quantity of inputs and ready to serve fruit beverage experiments; etc.
- Analytical techniques based on mixed effects models and biplot developed for the analysis of data generated from Farmers Participatory Trials for resource conservation agriculture have been used by rice-wheat consortium for Indo-Gangetic plains for drawing statistically valid conclusions.
- Analytical techniques for the analysis of data from the experiments conducted to study the post harvest storage behaviour of the perishable

commodities like fruits and vegetables are being widely used in NARES.

- Planning, designing and analysis of data relating to experiments under AICRPs on (i) Integrated Farming System (IFS); (ii) Long Term Fertilizer Experiments (LTFE); (iii) Soil Test Crop Response Corelation (STCR); (iv) Rapeseed and Mustard; (v) Sorghum; (vi) Wheat and Barley and (vii) Vegetable Crops.

Sample Surveys

The subject of sampling techniques helps in providing the methodology for obtaining precise estimat0rs of parameters of interest. The Institute is involved in evolving suitable sample survey techniques for estimation of various parameters of interest relating to crops, livestock, fishery, forestry, horticulture, perishable commodities like flowers, vegetables and allied fields.

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

Statistical Genetics and Genomics

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

- Developed procedures for estimation of genetic parameters; construction of selection indices; studying G × E interactions; progeny testing and sire evaluations; detection of QTLs, classification of genotypes using molecular marker data, etc.
- The modification in the procedure of estimation of genetic parameters has been suggested for incorporating the effect of unbalancedness, presence of outliers, aberrant observations and non-normality of data sets.
- Procedures for studying genotype environment and QTL environments interactions have been used for the analysis of data generated from crop improvement programmes.
- The research work on construction of selection indices, progeny testing and sire evaluation have

been used for animal improvement programmes.

- The Institute has initiated research in the newer emerging area of statistical genomics such as rice genome functional elements information system; comparative genomics and whole genome association analysis. The establishment of a National Agricultural Bioinformatics Grid (NABG) is a landmark in this direction.
- A number of databases and web services have been developed which include pigeonpea microsatellite database, buffalo microsatellite database, genome sequence submission portal, biocomputing portal, livestock EST database, insect barcode database, tomato microsatellite database, goat microsatellite database.
- Supercomputing facility (High Performance Computing System) has been established for biological computing and bioinformatics.

Statistical Modelling and Forecasting for Biological Phenomena

Statistical modelling of biological phenomena is carried out by using linear and non-linear models, non-parametric regression, structural time series, fuzzy regression, neural network and machine learning approaches.

- Developed models for pre-harvest forecasting of crop yields using data on weather parameters; agricultural inputs; plant characters and farmers' appraisal.
- Models have been developed using weather and growth indices based regression models, discriminant function approach, markov chain approach, bayesian approach, within year growth models and artificial neural network approach.
- Methodologies for forewarning important pests and diseases of different crops have been developed which enable the farmers to use plant protection measures judiciously and save cost on unnecessary sprays.
- Methodology developed for forecasting based on weather variables and agricultural inputs was used by Space Application Centre, Ahmedabad to obtain the forecast of wheat yield at national level with only 3% deviation from the observed one.
- Models developed for forewarning of aphids in mustard crop were used by Directorate of Rapeseed and Mustard Research, Bharatpur to provide forewarning to farmers which enabled them to optimize plant protection measures and save resources on unnecessary sprays consecutively for three years.
- Forecasting of volatile data has been attempted through non-linear time series models. Such models were developed for forecasting onion price, marine products export, lac export, etc.
- Non-linear statistical models were developed for aphid population growth and plant diseases. Modelling and forecasting of India's marine fish production was carried out using wavelet methodology. The models developed have potential applications in long term projections of food grain production, aphid population, marine fish production, etc.
- The Technology Forecasting methods such as scenario creation, Delphi survey and cross-impact analysis, technology road-mapping, analytic hierarchy process (AHP) etc. have been employed in various sub-domains of agriculture.
- Created a web solution for estimation of compound growth rate and several other resources.

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

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

Information Communication Technology

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

- The Institute has developed information system for designed experiments which includes

agricultural field experiments, animal experiments and long term fertilizer experiments conducted in NARES as research data repositories.

- A comprehensive Personnel Management Information System Network (PERMISnet) has been implemented for the ICAR for manpower planning, administrative decision making, and monitoring. A Project Information and Management System Network (PIMSnet) was developed and implemented for concurrent monitoring and evaluation of projects. This is being developed as a Project Information and Management System for all ICAR projects. A National Information System on Agricultural Education Network in India (NISAGENET) has been designed, developed and implemented so as to maintain and update the data regularly on parameters related to agricultural education in India.
- Online Management System for Post Graduate Education has been developed and implemented for PG School, IARI, New Delhi. The Institute has taken a lead in the development of Expert Systems on wheat crop, maize crop and seed spices. AgriDaksh has been developed for facilitating the development of expert systems for other crops.
- Web based software for Half Yearly Progress Monitoring (HYPM) of scientists in ICAR (http://hypm.iasri.res.in) has been developed and implemented from April 2012 for online submission of data regarding the proposed targets and the achievements for the half yearly period. It enables to monitor online progress of the scientists, manpower status, research projects, prioritized activities and salient research achievements at institute/SMD/ICAR level.
- Realizing the need of integration of databases to prepare a comprehensive knowledge warehouse that can provide desired information in time to the planners, decision makers and developmental agencies, Integrated National Agricultural Resources Information System (INARIS) has been developed. The data warehouse comprises of databases on agricultural technologies of different sectors of agriculture and related agricultural statistics at district/state/national levels, population census including village level population data as well as tehsil level household assets and livestock census. Subject-wise data marts have been designed, multi-dimensional data cubes developed and published in the form of on-line decision support system. It is being developed as knowledge data warehouse through the development of Knowledge Management for Agricultural Research and Technologies (KMART). The system also provides facility of spatial analysis of the data through web using functionalities of Geographic Information System (GIS).
- Strengthened Statistical Computing facilities in NARS, helped in capacity building in the usage of high end statistical computing and developed Indian NARS Statistical Computing Portal for providing service oriented computing to the researchers of NARES, which has paved the way for publishing agricultural research in high impact factor journals.
- A number of software and web solutions have been developed for the agricultural research workers: Statistical Package for Agricultural Research (SPAR) 2.0, Statistical Package for Block Designs (SPBD) 1.0, Statistical Package for Factorial Experiments (SPFE) 1.0, Statistical Package for Augmented Designs (SPAD) 1.0, Software for Survey Data Analysis (SSDA) 1.0, Statistical Package for Animal Breeding (SPAB) 2.1, Online Analysis of Block Designs, Web Generation and Analysis of Partial Diallel Crosses, Web Generation of Designs Balanced for Indirect Effects of Treatments etc.
- A Vortal has been designed and developed to facilitate online management of all training programs [Centre for Advanced Faculty Training (CAFT), Summer-Winter Schools (SWS) and Short Courses (21/10 days duration)] under Capacity Building Program (CBP) sponsored by Agricultural Education Division, ICAR.
- For providing transparency in day to day work of the ICAR/Institute, ICAR-ERP system has been implemented with the Financial Management, Project Management, Material Management, Human Resource Management and Payroll System modules. The system is hosted on IASRI website and can be accessed through URL http://icarerp.iasri.res.in. It can also be visited through http://www.iasri.res.in/misfms/.

Human Resource Development

One of the thrust areas of the Institute is to develop trained manpower in the country in the disciplines of Agricultural Statistics and Informatics for meeting the challenges of agricultural research in the newer emerging areas.

- The Institute conducts degree courses leading to M.Sc. and Ph.D. in Agricultural Statistics, M.Sc. and Ph.D. in Computer Application and M.Sc. in Bioinformatics in collaboration with Indian Agricultural Research Institute (IARI), New Delhi. Ph.D. degree in Bioinformatics has also been initiated from academic session 2014-15. The Institute has so far produced 191 Ph.D. and 336 M.Sc. students in Agricultural Statistics, 120 M.Sc. students in Computer Application and 11 M.Sc. students in Bioinformatics.
- The Institute is functioning as a Centre of Advanced Studies in Agricultural Statistics and Computer Application (CAS) re-named as Centre of Advanced Faculty Training (CAFT). Under this programme, the Institute organizes training programmes on various topics of interest for the benefit of scientists of NARES. These training programmes cover specialized topics of agricultural sciences. So far, 66 training programmes have been organized under the aegis of CAS/CAFT and in all a total of 1172 participants have been benefited.
- The Institute conducts the Senior Certificate Course in Agricultural Statistics and Computing. This course is of six months duration and lays more emphasis on statistical computing using statistical software. The course is divided into two modules viz. (i) Statistical Methods and Official Agricultural Statistics, and (ii) Use of Computers in Agricultural Research, of three months duration each. In all 89 participants have completed both the modules, 42 have completed module-I and 23 have completed module-II since 1997.
- There is another form of training course, which are tailor made courses and are demand driven. The coverage in these courses is need based and the courses are organized for specific organizations from where the demand is received. The Institute has conducted such programmes for Indian Council of Forestry Research, Indian Statistical Service probationers, State Department of Agriculture and senior officers of Central Statistical Office and many other organizations.
- The Institute has also conducted several international training programmes on request from FAO, particularly for African, Asian and Latin American countries.
- The Institute has broadened the horizon of capacity building by opening its doors to the agro-based private sector. One such training programme was organized for research personnel of E.I. DuPont Pvt. Ltd. The Institute has also conducted training programmes for the scientists/research personnel of CGIAR organizations such as ICARDA and Rice-Wheat Consortium for Indo-Gangetic plains.

Infrastructural Development

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

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

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

masters, 3072 cores and 38 Tera Flops computing, (ii) 16 nodes windows cluster with one master, (iii) 16 nodes GPU cluster with one master with192 CPUs + 8192 GPUs and (iv) SMP based machine with 1.5 TB RAM. Also, this hub has approximately 1.5 Peta Byte storage divided into three different types of storage architecture i.e. Network Attached Storage (NAS), Parallel File System (PFS) and Archival. This hub also consists of super-computing systems (16 node Linux cluster with one master and 40 TB storage) at National Bureaux of Plant Genetic Resources (NBPGR) New Delhi, National Bureaux of Animal Genetic Resources (NBAGR) Karnal, National Bureaux of Fish Genetic Resources (NBFGR) Lucknow, National Bureaux of Agriculturally Important Microbes (NBAIM) Mau and National Bureaux of Agriculturally Important Insects (NBAII), Bangalore which forms a National Agricultural Bioinformatics Grid in the country.

There are various labs in the Institute for dedicated services like ARIS lab for training, Statistical computing lab, Student lab and Centre of Advanced Study lab. An Agricultural Bioinformatics Lab (ABL) fully equipped with software and hardware to study crop and animal biology with the latest statistical and computational tools was also established. Business Intelligence Server has also been installed for statistical computing for NARES. A laboratory on Remote Sensing (RS) and Geographic Information System (GIS) was created in the Institute. The laboratory is equipped with latest state-of-art technologies like computer hardware and peripherals, Global Positioning System (GPS), software like ERMapper, PCARC/INFO, Microstation 95, Geomedia Professional, ARC/INFO Workstation and ERDAS Imagine with the funds received through two AP Cess Fund projects. This computing facility has further been strengthened with the procurement of ARC-GIS software.

Some of the important available software are SAS 9.2, 9.3, 9.4 JMP 8.0, 9.0, 10.0 JMP Genomics 4.0, 5.1, 6.0, SAS BI Server 4.2, SPSS, SYSTAT, GENSTAT, Data warehouse software – Cognos, SPSS clementine, MS Office 2007, Linux OS, MS Visual Studio.net, MS-SQL Server, Microsoft SQL DBMS, Microsoft Exchange 2013, Microsoft Lync 2013, Unix based AIX Operating System, Oracle, Oracle Fusion Middleware 12C, Oracle ERP Release 12.1.3, Macro-Media, E-views, STATISTICA Neural Networks, Gauss Software, Minitab 14, Maple 9.5, Matlab, Web Statistica, Lingo Super, Discovery Studio, CLC Bio, SAS Modules of Text Mining and Data Management & Integration, ArcGIS among others.

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

Local Area Network of IASRI has been strengthened with state of art Ethernet Passive Optical Network (EPON) with 344 nodes. The technology has triple play service Data, Video and Voice with modular planning. The networking services at IASRI have been further strengthened. The entire IASRI campus is Wi-Fi enabled with a high speed internet connection to allow the staff and students to access the internet no-matter wherever they are. The coverage of Wi-Fi is not only restricted to labs but also extends to all the areas including library, auditorium and hostels.

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

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

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

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

Organizational Set-up

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

Divisions

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

Unit

- Institute Technology Management Unit (ITMU)

Cells

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

Financial Statement

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

Budget Allocation vis-à-vis Utilization (2015-16) Institute Plan & Non-Plan

(Rs. in lakhs)

Head of Accounts	Allocation		Expenditure	
	Non-Plan	Plan	Non-Plan	Plan
Pay & Allowances + Pension & other retirement benefits	2636.50000	0.00000	2591.73389	0.00000
TA	6.04000	6.25000	6.03981	6.24661
OTA	0.40000	0.00000	0.20816	0.00000
HRD	10.00000	0.77000	8.08345	0.74390
Fellowship	52.00000	0.00000	51.99891	0.00000
Research & Operational	10.00000	10.41000	9.20668	8.32171
Equipments	7.00000	17.64000	4.24361	17.58527
Information Technology	0.00000	0.00000	0.00000	0.00000
Furniture	0.00000	0.36000	0.00000	0.34538
Works	0.00000	25.00000	0.00000	25.00000
Library	0.00000	40.00000	0.00000	39.99702
Loan & Advances	6.00000	0.00000	3.96000	0.00000
Administrative Expenses	526.00000	75.19000	499.98369	75.06836
Guest House Maintenance	1.00000	1.55000	0.92961	1.54529
Other Miscellaneous	0.00000	203.83000	0.00000	203.83078
Total	**3254.94000**	**381.00000**	**3176.38781**	**378.68432**

Staff Position (as on 31 March 2016)

Manpower	No. of posts sanctioned	No. of posts filled
Director	1	1
Scientific	130	64
Technical	215	65
Administrative	84	65
Canteen	14	8
Skilled Supporting Staff	78	40
Total	**522**	**243**

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

Research Achievements

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

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

Programme 1: DEVELOPMENT AND ANALYSIS OF EXPERIMENTAL DESIGNS FOR AGRICULTURAL SYSTEM RESEARCH

Experimental Designs in the Presence of Indirect Effects of Treatments

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

A series of row-column designs partially balanced for adjacent directional spatial indirect effects (neighbour effects) upto order two in four directions have been obtained for even number of treatments with parameters v, $p = v$, $q = v$ and $\mu = 1$. The concept of experimental designs in the presence of spatial and temporal indirect effects of treatments is being explored and accordingly the designs would be constructed. A series of experimental designs balanced for spatial and temporal indirect effects of treatments has been constructed. The properties of the series of experimental designs balanced for spatial and temporal indirect effects of treatments constructed have been studied.

Bio Acoustic Tool: A Novel Non-Invasion Approach for Efficient Monitoring of Health and Productivity in Dairy Animals

Data sets on four phases of estrous cycle namely Proestrus, Estrus, Metestrus and Diestrus have been received and being analysed by using PROC MIXED for fitting the compound symmetric structure using REPEATED term in SAS 9.3. To test the hypothesis that the sound produced by animals during their vocalizations in different phases of oestrous cycle can be used as identifiers of the animal breed or species even if they sound the same to unaided human ear, three Artificial Neural Networks (ANNs)

were developed using bioacoustics properties as inputs for the respective automatic identification. Statistical analysis on received data sets on four phases of estrous cycle is in progress. Some of the results have been sent to the Lead centre, NDRI, Karnal for inclusion in the final report of the project.

Planning, Designing and Analysis of Experiments Planned ON STATION for AICRP on IFS

The experiments on stations under the Project Directorate for Farming Systems Research are planned and conducted under four types of research programmes viz. (i) development of new cropping systems; (ii) nutrient management in cropping systems; (iii) development of system based management practices and (iv) maximum yield research. These experiments are conducted using Randomized complete block (RCB) design, Factorial RCB design, Split plot designs, Strip plot designs, 3^2 x 2 balanced confounded factorial experiments and Split-split plot design.

Analysis of twenty five centres for all the three seasons for the experiment entitled Permanent plot experiment on integrated nutrient management in rice-wheat cropping sequence (2a), twenty centres for all the three seasons for the experiment entitled Development of organic farming package for system based high value crops (OF) have been completed. The combined analysis of the experiment entitled Permanent plot experiment on integrated nutrient supply system in a cereal based crop sequence (2010-11 to 2013-14) of four centers (Jorhat, Kalyani, Ranchi and Sabour) for both Kharif and Rabi seasons have been performed. Analysis work for the experiment 1a (Intensification/Diversification experiment) for two centres for the year 2013-14 has been completed and final tables have been sent to IIFSR, Modipuram. Data of the experiment 1a and OF for Ludhiana, Bichpuri and Durgapura and 2a for Ludhiana and Bichpuri for the year 2014-15 have been received. Performed the combined analysis of the experiment entitled Sustainable production model (2009-10 to 2013-14) of two centres for both Kharif and Rabi seasons.

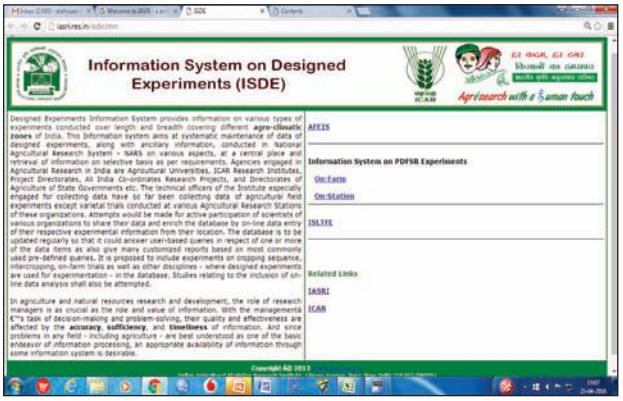
Under the experiments entitled Development of Innovative Farming Practices to Mitigate the Effect of Climate Change which was started with two main plot factors [Tillage (two levels viz., T1 and T2) and Cropping System (three levels viz., CS1, CS2 and CS3)] and two sub plot factors [Mulch (two-levels viz., M1 and M2) and Fertilizer rates (two-levels viz., F1 and F2)], analysis of data pertaining to ten centres viz., Raipur, BAU/Sabour, Bhubaneswar, Kanpur, Kota, SK Nagar, Chiplima, Coimbatore, Navsari and Parbani for the year 2013-14 was performed. Multiple comparisons among various effects and their interactions, wherever significance was observed by using Tukey's HSD and identified the best treatment combination for each of the centres. Before analyses data on grain yield have been converted to calorific value and gross return to make them comparable.

Designing and Analysis of ON FARM Research Experiments Planned for AICRP on IFS

One-way ANOVA has been carried out to identify the best Farming System and paired t-test has been carried out for comparing existing and diversified data (with respect to production, marketable surplus, cost, return and profit) under different farming systems as well as considering all the households as a whole for all the centres under OFR2 and OFR3. The results were scrutinized and summarized and the summary tables of analyzed results pertaining to OFR2 and OFR3 have been sent to ICAR-IIFSR. Non-parametric tests *viz*., sign test and Wilcoxon signed rank test were applied to compare the farming systems under existing and diversified conditions for one centre under OFR2, as the number of households are not sufficient to carry out a parametric paired t-test. The results are found to be in accordance with paired t-test results. A joint workshop of ICAR-IASRI and ICAR-IIFSR was organized under AICRP-IFS and statistical methodology and issues for data analysis pertaining to ON FARM experiments were discussed in depth. Till March 2016, twenty nine centres have submitted OFR1 data online out of which twenty two centres entered data correctly for the year 2014-2015.

Information System for Designed Experiments (ISDE)

ISDE is a web-enabled information system (http://iasri.res.in/isde.htm) wherein, presently, information



relating to databases on agricultural field experiments (excluding purely varietal trials) conducted in the country namely on-farm and on-station experiments conducted under the supervision of Indian Institute of Farming System Research and Long Term Fertilizer Experiments are stored and maintained online. During the period under report, regular activities like collection, storage, validation and retrieval of experimental data was done. Agricultural Field Experiments Database contains more than 37000 experiments on different crops and designs.

Planning, Designing and Analysis of Data Relating to Experiments for AICRP on Long Term Fertilizer experiments

Data for ICAR-IARI, New Delhi centre for 2012-13 have been analyzed for both regular and superimposed treatments and the analyzed results have been sent to centre in-charge. Data for Jabalpur centre for 2012-13 and 2013-14 have been analyzed and the analyzed results have been sent to centre in-charge. Data of Akola centre have been received for developing soil quality index. Data for Ranchi centre for 2013-14 and 2014-15 have been analyzed for both regular and superimposed treatments and the analyzed results have been sent to centre in-charge. Data for Raipur for 2010-11, 2011-12, 2012-13 and 2013-14 for both Kharif and Rabi seasons have been analyzed and sent to centre in-charge. Utilization certificate for the year 2014-15 has been sent to the Project Coordinator, AICRP LTFE, IISS, Bhopal. Data from Bangalore centre has been analyzed for the year 2012-13 and 2013-14 for both original data and superimposed data. Data from Pantnagar centre has been analyzed for the year 2011-12, 2012-13 and 2013-14 for both original data and superimposed data and reports have been sent to centre in-charge. R code for analyzing data for superimposed treatments for New Delhi, Ranchi, Bangalore and Pant Nagar centres have been prepared.

Factorial Experiments with Minimum Level Changes in Run Sequences

Randomization of run sequences is a technique commonly employed by the users of factorial designs in order to avoid bias in the estimates of the effects of interest which might result from a time trend. However, randomization of run sequences in factorial experiment can induce a large number of changes in factor level and thus make experimentation expensive, time-consuming and difficult. The criterion of number of level changes is one of the most important criteria particularly for experiments which involve hard-to-change factors i.e. factors for which it is difficult to change the levels both in terms of cost and time. Considering this, a general methodology has been developed to construct any combination of mixed level factorial design with minimally changed run sequences. Based on the method, along with total number of changes for a minimally changed run sequences, the general expression has also been obtained for calculating factor-wise number of level changes. Since, minimally changed run sequences in factorial design is not unique, thus, an exhaustive search algorithm has been developed to generate all possible minimally changed run sequences for a particular factorial design along with factor-wise number of level changes which would help in selecting any minimally changed run sequence randomly out of all possible minimally changed run sequences and hence can minimize any systematic bias which may be introduced due to the lack of randomization.

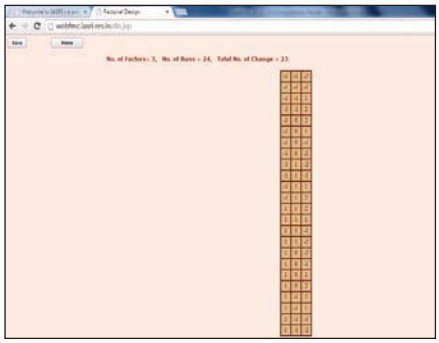
For the developed minimally changed run sequences, a recurrence relationship was established between time count value of any effect in a $\prod_{i=1}^{k-1} s_i$ factorial [where there are k factors and the i^{th} factor is having s_i levels for all $i = 1,2,...,k$] with minimally changed run sequences and the time count value of the same effect in a $\prod_{i=1}^{k} s_i$ factorial with minimally changed run sequences obtained based on the $\prod_{i=1}^{k-1} s_i$ factorial with minimally changed run sequences. The recurrence relation for symmetric factorial was obtained as a special case. A method for constructing half replicate of 2^k factorial with minimally changed run sequences was developed based on the method of generator. The number of level changes for the generated factor in the developed half replicate of 2^k factorial with minimally changed run sequences was obtained as the sum of number of changes of individual factors used in generation of the last factor.

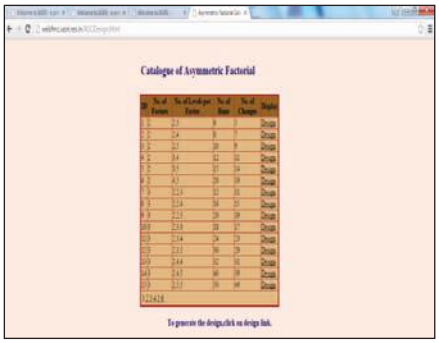
For the developed 2-level fractional factorial with minimally changed run sequences, the general expression for factor-wise number of level changes has also been obtained. For i^{th} $(i = 1,2,...,k-1)$ original factor, the factor-wise number of level change will be 2^{i-1} whereas for the generated factor, it will be $2^{k-1} - 1$. It should be noted that, in case of fractional factorial with minimally changed run sequences, total number of change will not be one less than the number of

runs. In case of half replicate of 2^k factorial with minimum number of changes, the total number of change based on the above method is twice the number of changes of the generated factor i.e. $2(2^{k-1}-1)$. A SAS macro for the generation of half replicate of 2^k factorial with minimally changed run sequences was developed. Along with the designs, the macro also highlights factor wise number of level changes and total number of changes.

accomplished. The facility of generating Factorial RCB designs in Experiment Creation Module was also added.

Attribute values in 15 database tables (i) crop family; (ii) crop; (iii) season; (iv) zone; (v) state; (vi) location; (vii) organization type; (viii) organization details; (ix) new lines; (x) checks; (xi) observation names; (xii) units; (xiii) group stage; (xiv) testing zones and (xv) testing levels have been updated, finalized and made functional on the server.





The method for constructing minimally changed run sequences under factorial experiment set up may involve theoretical understanding from user point of view. An open access web solution named webFMC (http://webfmc.iasri.res.in.) has been developed to generate any combination of symmetric and asymmetric factorial design with minimally changed run sequences. An online catalogue of such run sequences has also been developed and integrated with webFMC and made available in public domain at http://webfmc.iasri.res.in.

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

The website of AICRP on Vegetable Crops was updated by adding the links on Varieties developed; Annual Report 2014-15 and Document on Four Decades and AICRP on Vegetable Crops was

AICRP on Vegetable Crops

Test Agronomy

Experiment ID:29

Objectives

Testing Agronomy factorial

Observations to be collected

Observation Name	Observation Unit
Days to first fruit harvest	Number

Locations

Name of the Location	Incharges
Akola_pdkv	I/C PDKV Akola

Experiment ID:29

Vegetable Production

Test Agronomy

Treatment Details with Random Coding

Factor Name:Nitrogen	Factor Name:Phosphorus
40	20
80	30
	40

Vegetable Production

Test Agronomy

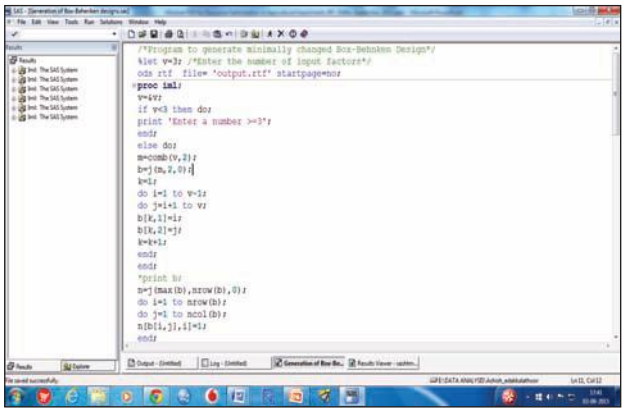
Location: Akola_pdkv

Replication1	
Exp. Unit	**Treatment Combination**
1	40 30
2	80 30
3	40 40
4	40 20
5	80 20
6	80 40
Replication2	
Exp. Unit	**Treatment Combination**
1	40 20
2	40 30
3	80 40
4	80 30
5	40 40
6	80 20
Replication3	
Exp. Unit	**Treatment Combination**
1	80 40
2	80 30
3	80 20
4	40 20
5	40 40
6	40 30

Minimal Response Surface Designs for Resource Optimization in Agricultural Experiments

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

Using SAS Macros, a method was developed for obtaining Box-Behnken Design with minimum level changes in the run sequences. General expression for factor-wise change as well as the total change of minimal Box-Behnken Design was derived. Catalogue of minimal Box-Behnken Design has been prepared upto 10 factors. The catalogue consists of number of input factors, total level changes, factor-wise level changes and the number of runs.



A-optimal Block Designs for Comparing Treatments with Control Treatment(s): An Algorithmic Approach

Given number of test treatments (v), number of blocks (b) and block size (k), parametric combinations have been obtained which satisfy the sufficient condition for a block design to be A-optimal for comparing test treatments with a control treatment. An algorithm has been developed to construct A-optimal balanced treatment incomplete block designs for given parametric combinations. The algorithm obtains values of two parameters *s* and *t* based on sufficient conditions of A-optimality and then obtains desired number of replications of test and control treatments. If a BTIB design exists for this parametric combination, then the algorithm is most likely to obtain an A-optimal design. The developed algorithm to construct A-optimal BTIB design for given parametric combinations has been implemented in R programming language. The developed algorithm has been utilized to construct A-optimal BTIB designs in the parametric range of number of test treatments less than or equal to 30, number of blocks less than or equal to 50 and block size less than or equal to 10. 115 A-optimal BTIB designs have been obtained in the above parametric range. An algorithm is developed to obtain A-optimal Group Divisible Treatment (GDT) Designs for comparing several test treatments with a control treatment. A total of 130 A-optimal GDT designs have been obtained using the proposed algorithm in a restricted parametric range.

Some Investigations on Trend Resistant Row-Column Designs

In agricultural and allied experiments, situations are quite common where there may be evidences of two sources of variability apart from the treatment

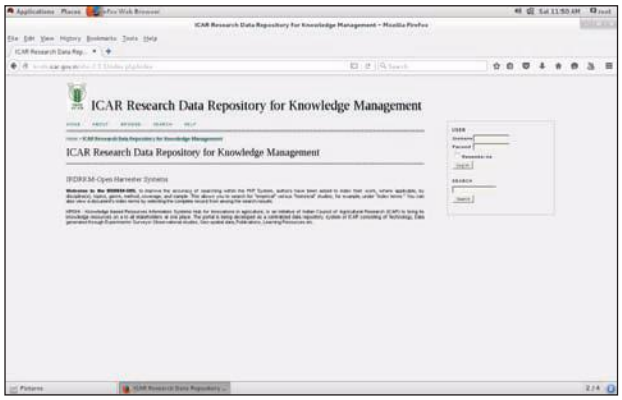
applied to the experimental material. Row-Column designs are useful for this situation. In agricultural experiments, response may be affected by systematic trend. Thus, trend component should be incorporated in to the row-column model. Further, apart from the trend effect, it may be the situation that the response of a particular experimental unit may also be affected by the neighbour effects from its adjacent unit. Under this situation, it is important to study row-column model incorporating trend component with neighbour effects. Trend resistant row-column designs with neighbour effects should be obtained for this situation. Further, it may be the case that the observations may be correlated. Thus, this should also be taken in to account for row-column designs incorporating trend component. Considering this, the information matrix for estimating the treatment effects under row-column designs with one direction trend component has been obtained. The condition for a row-column design with one direction trend component to be trend free has been obtained based on the information matrix.

ICAR Research Data Repository for Knowledge Management as KRISHI: Knowledge based Resource Information System Hub for Innovations in Agriculture

- A portal called KRISHI (http://www.krishi.icar.gov.in) - Knowledge Based Resources Information Systems Hub for Innovations in Agriculture has been initiated. This portal would consist of six repositories namely (i) Technology Repository (ii) Publication Repository (iii) Experimental Data Repository (iv) Observational Data Repository (v) Survey Data Repository and (vi) Geo-portal.

- To sensitize the nodal officers about the ICAR Research Data management Policy and to discuss the future course of action for implementation, a Workshop of Nodal officers was organized in which five technical sessions (i) ICAR Research Data Management Policy; (ii) Technology and Publication Repository; (iii) ICAR Geo-Portal; (iv) Unit Level Data Repository and (v) Workflows and IT Infrastructure were organized.
- Several online resources available/developed at different ICAR institutes are now accessible through KRISHI portal. At present, this portal provides information about 134 online resources developed by different ICAR institutes. Some Online resources (out of 134) have been initiated by Institutes as a follow up action of KRISHI, e.g. JAFexpert (ICAR- Central Research Institute for Jute & Allied Fibres, Barrackpore); Banana Technologies (ICAR-NRC on Banana, Tiruchirapalli); Vegetable varieties (ICAR-IIVR, Varanasi); http://icar-ciwa.org.in/gks/ (ICAR-Central Institute for Women in Agriculture, Bhubaneswar), etc.
- A new link on Krishi Vigyan Kendras has been initiated at http://krishi/kvk.jsp in which links of URLs of KVKs in different zones except zone 4 and 5 have been provided.
- Technology repository of the Portal has been enriched with information regarding 30 popular technologies related to Crop Production, Plant Protection, Soil and Water Management, Horticulture, Animal Science, Fisheries and Agricultural Engineering as well as information about commercialised/ ready for commercialisation technologies. 'Livestock Technologies - Way to diversified Agriculture' under the link Popular Technologies on Technology Repository page. Links of Varieties developed by 18 Institutes have also been provided under the link Developed Varieties on Technology Repository page. Draft Formats for Technology Repository finalized and made available at KRISHI Portal. Online Proforma and reporting module are being implemented.
- It has been decided that all Institutes to get registered as communities in KRISHIKOSH and upload their publications; Deemed Universities to upload Dissertation/ Thesis. As a follow up action of Nodal officers Workshop, 02 new Institutes joined in KRISHIKOSH and several others have submitted their requests for registration.
- Metadata harvesting from Open Archives Initiative Protocol for Metadata Harvesting (OAI-

PMH) protocol enabled web applications has been initiated. Metadata has been harvested from KRISHIKOSH, CMFRI Eprints, NAARM Eprints, DSpice, Indian Agricultural research Journals, OAR@ICRISAT, etc. Search is ready for the above six repositories for 80847 records (Unified search across these resources) at http://krishi.icar.gov.in/ohs-2.3.1/index.php/browse.



- A geo-portal has been initiated to provide spatially referenced information. At present following spatial data and layers have been provided on ICAR geo-portal: (i) ICAR Institutes/ Regional Centres locations/KVKs from Zone 2 and Zone 3; (ii) Soil maps (1:1 million), slope, soil depth, soil erosion, surface texture maps; (iii) Agro-ecological regions and sub-regions; (iv) Vulnerability map and climate layers; (v) Wind Erosion Map; (vi) Crop Residue State wise data and (vii) Fire locations related to paddy residue burning between 15 October 2015 to 20 November 2015 in the State of Punjab and Haryana. KRISHI Geoportal version is being upgraded to enable Web Map Service (WMS) for seamless importing of data layers available from other geo-portals, such as ISRO portal Bhuvan providing valuable information to policy makers and researchers.
- Space Technology Application in Agricultural Research cell has also been constituted for coordinating with various ICAR Institutes and other stakeholders for ensuring smooth implementation of the programme of Space Technology Application in Agricultural Research.
- Standardization of Data Formats and their Process flow for creating these repositories are being finalized. Procurement of necessary hardware and software tools are in progress.
- In the first phase, all efforts are being made to sensitise the researchers about the importance of digitization of research data. The reporting/ analysis, etc. may be taken up in the next phases. Sensitisation seminars have been organized in 84 ICAR Institutes.
- List of ongoing and completed research projects that have been made available in Open Access through PIMS-ICAR.
- ICAR-NRC on Pig, ICAR-NRC on Grapes; ICAR-NIHSAD, Bhopal; ICAR-CIAE, Bhopal issued numbered registers to each scientists/labs for entering and maintaining raw data, which needs to be submitted to Institute. Some others are in the process.
- In the first phase of Unit level data repository, following 10 AICRPs/ Institutions have been identified (i) AICRP on Farm Implements and Machinery; (ii) AICRP on Post Harvest Technology; (iii) AICRP on Poultry; (iv) AICRP on FMD; (v) AICRP on Long Term Fertilizer Experiments; (vi) AICRP on Water Management; (vii) AICRP on Weeds; (viii) AICRP on Fruits; (ix) Central Institute of Fisheries Technology, Cochin and (x) All India Coordinated Sorghum Improvement Programme. For Experimental data repository implementation for AICSIP, ICAR-IIMR, Hyderabad; AICRP on LTFE (ICAR-IISS, Bhopal) is in progress and implementation would be initiated for rest. Beginning has been made for implementation of AICRP on Fruits, AICRP on Weeds. The project team members visited the following Institutes for having discussions on unit level data repositories: (i) CIAE, Bhopal for AICRP on FIM; (ii) CIFT, Kochi; (iii) Directorate on Poultry Research, Hyderabad for AICRP on Poultry and (v) IIWM, Bhubaneswar for AICRP on Water Management.
- Online Module for Meta Data (SMD, Institute, Division, Project, scientists responsible for generating data, indexing of data about type, location, extent of availability, the source of data, format in which available, etc.)
- A presentation on Progress of KRISHI and Challenges Ahead was presented in Director's Conference held at New Delhi. To review the progress made and discuss the way forward for implementation of ICAR Research Data Repository for Knowledge Management, many Core Team meetings and the meetings of Steering Committee were held. A workshop on 'ICAR-KRISHI Geoportal' for experts and two workshops for users were organized where

various aspects of Databases on Agricultural resources, data requirements and future course of action of KRISHI Geo-portal were deliberated.

On Construction of Orthogonal and Nested Orthogonal Latin Hypercube Designs

Latin hypercube designs have proved to be a popular choice for experiments run on computer simulators and in global sensitivity analysis. The columns of a Latin hypercube design (LHD) represent the input factors and, the rows, the experimental runs. Different approaches have been suggested and developed in the literature for constructing Latin hypercube and orthogonal Latin hypercube with desirable properties. One such approach consists of finding Latin hypercube with zero correlations between pairs of input factors (or, columns). In terms of Latin hypercube designs, this requirement is equivalent to the condition that (a) the columns of the design are mutually orthogonal. Designs satisfying condition (a) are called orthogonal Latin hypercube designs (OLHD) and named as 1st order OLH(n, m). First order OLH(n, m) designs ensure independence of estimates of linear effects when a first order model is fitted. However, if a second-order model is needed, then it is desirable that the Latin hypercube design satisfies condition (a) and additionally, the following condition: (b) the element-wise square of each column and the element-wise product of every two columns are orthogonal to all columns in the design. A Latin hypercube design with n rows and m columns satisfying both (a) and (b) are denoted by second order OLH (n, m) design. A 2nd order OLH (n, m) design ensures that not only the estimates of linear effects are mutually uncorrelated but they are also uncorrelated with the estimates of quadratic and interaction effects in a second order model.
Developed a method for construction for first order and second order orthogonal Latin hypercube designs with 4 factors and any possible runs. Developed a method for construction for first order orthogonal Latin hypercube designs with 6 factors and any possible runs. Developed method of construction for second order orthogonal Latin hypercube designs with 6 factor and any possible runs has been in progress.

Strengthening Statistical Computing for NARS

Installation, License Files and Technical support

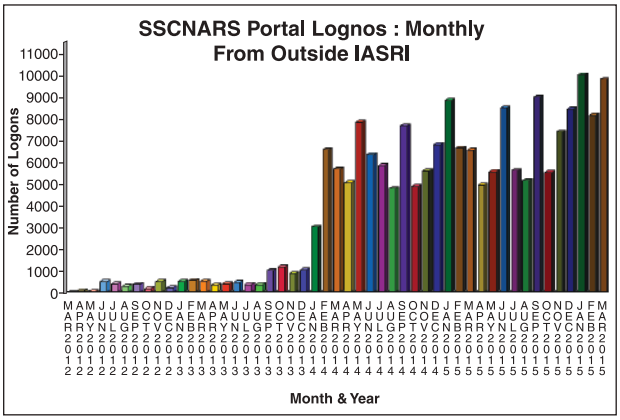
- License files of SAS 9.2, 9.3, JMP 8, 9, 10 and JMP Genomins 4.1, 5.0 and 6.0 for 2015-16 were uploaded on Resource Page of Indian NARS Statistical Computing Portal and all Nodal Officers were informed through E-mail regarding their availability.
- A document for installing Muti-Java Environment on a given system has been prepared and circulated for resolving the issue of compatibility versions of JAVA for ICAR ERP and SAS. This document has also been uploaded on Project website www.iasri.res.in/sscnars.
- Technical support regarding installation issues and license renewal, was provided to Nodal Officers/ researchers from ICAR-CRIDA, Hyderabad; ICAR-CRRI, Cuttack and ICAR-Indian Institute of Maize Research, New Delhi: for resolving SAS EG 4.2 expiration notice; ICAR-Directorate of Soybean Research, Indore: regarding technical support for updating license files of JMP; Head, regional Centre ICAR-NBSS&LUP, Jorhat: regarding Installation of SAS; ICAR-NBAGR, Karnal: regarding installation of JMP Genomics; ICAR-NBPGR, New Delhi: regarding preparing a copy of the depot and ICAR-IIWM, Bhubaneswar: regarding installation.
- Organized a Lecture Series on SAS for Statistical Procedures for Students of discipline of Agricultural Economics, PG School, ICAR-IARI, New Delhi.

Indian NARS Statistical Computing Portal

- For accessibility of Indian NARS Statistical Computing Portal and downloading of license files, updated IP addresses of following 56 NARES Organizations: (i) UAHS, Shimoga; (ii) ICAR-DOR, Hyderabad; (iii) ICAR-Directorate of Seed Reseach, Mau; (iv) ICAR-CSSRI, RRS Bharuch; (v) ICAR-Directorate of Rapeseed and Mustrad Research, Bharatpur; (vi) ICAR-NBPGR Regional Station, Hyderabad; (vii) ICAR-IVRI, Izatnagar; (viii) ICAR-CISH, Lucknow; (ix) ICAR-NRC Mithun, Medziphama; (x) ICAR-NRC on Litchi, Muzaffarpur; (xi) ICAR-CIAE, Bhopal; (xii) ICAR-CICR, Nagpur; (xiii) GKVK UAS, Bengaluru; (xiv) ICAR-RCER, Patna; (xv) ICAR-CIFRI, Barrackpore; (xvi) ICAR-Indian Institute of Maize Research, Winter Nursery Centre, Hyderabad; (xvii) ICAR-NAARM, Hyderabad; (xviii) ICAR-NIANP, Bengaluru; (xix) ICAR-NIVEDI, Bengaluru; (xx) ICAR-NIBSM, Raipur; (xxi) ICAR-CICR, Meerut; (xxii) ICAR-NRC on Camel, Bikaner; (xxiii) ICAR-IIWM, Bhubaneswar; (xxiv) ICAR-CIFA, Bhubaneswar; (xxv) ICAR-CSWRI, Avikanagar; (xxvi)

ICAR-DPR, Hyderabad; (xxvii) SKUAST-K, Srinagar; (xxviii) RVSKVV, Gwalior; (xxix) Birsa Agricultural University, Ranchi; (xxx) SKNAU, Jobner; (xxxi) GBPUAT, Pantnagar; (xxxii) ICAR-CIBA, Chennai; (xxxiii) ICAR-CAZRI, Jodhpur; (xxxiv) ICAR-CTRI, Rajmundary; (xxxv) ICAR-IISS, Bhopal; (xxxvi) ICAR-IIOPR, Pedavegi; (xxxvii) ICAR-IINRG, Ranchi; (xxxviii) ICAR-IISR Regional Station, Appangala; (xxxix) ICAR-Directorate of Soybean Research, Indore; (xl) UAS, Raichur; (xli) RAU, Samastipur; (xlii) Horticulture Department, Dr. PDKV, Akola; (xliii) SKUAST-J, Jammu; (xliv) Navsari Agricultural University, Navsari; (xlv) Punjab Agricultural University, Ludhiana; (xlvi) Junagarh Agricultural University, Junagarh; (xlvii) Directorate of Groundnut Research, Junagarh; (xlviii) CCS HAU, Hisar; (xlix) MPUAT, Udaipur; (l) ICAR-CIRCOT, Mumbai; (li) College of Agriculture, Nagupr under the jurisdiction of Dr. Panjabrao Deshmukh Krishiv Vidyapeeth, Akola; (lii) ICAR-Central Citrus Research Institute Nagpur; (liii) ICAR-IARI, New Delhi; (liv) PAU Regional Research Station, Gurdaspur;(lv) Institute of Agriculture, Visva Bharati, Sriniketan and (lvi) ICAR-IIMR, Hyderabad have been updated.

- The server stat.iasri.res.in has been shifted to data centre with change of Local IP. For running Indian NARS Statistical Computing Portal, new IP address was defined in Registry and for generating usage report, all codes for generating usage reports were updated with new Local IP query.
- The portal is being extensively used throughout NARES and helped the researchers in analyzing their data in an effective manner. Based on the user logged information, the total number of logged in users from Indian NARES during April 01, 2015- March 31, 2016 are 87,392 which is on an average more than 235 logged in per day.



Sensitization of Researchers

- Website of the project is being maintained and updated regularly. The website has been updated by including the (i) Multi Java environment user guide uploaded (available in "Publications" link) (ii) Updated Reference Manual on Data Analysis Using SAS by updating two Chapters on (a) SAS for Statistical Procedures and (b) Design Resources Server and (iii) updated list of Nodal Officers.
- Website is registered under google analytics on November 15, 2010. Till March 31, 2016, there were **80,305** page views across **551** cities of **80** countries. Average time on page is 2.54 minutes. During April 01, 2014 - March 31, 2015, there were **19,039** page views across **419** cities of **80** countries.
- An e-mail was sent to all Nodal Officers regarding usage of the Statistical Computing Environment

on March 11, 2015. As a follow up action on this mail, nodal officers from ICAR-IARI, New Delhi; ICAR-IASRI, Lucknow, ICAR-DMAPR, Anand; ICAR-IIVR, Varanasi and ICAR-CRIJAF, Barrackpore informed that 5, 6, 2, 2 and 1 research papers (16) have been published / accepted for publication in which statistical computing environment has been used. Nodal Officer from DMAPR, Anand also informed that 15 data sets have been analysed during the year. Feedback from other Nodal Officers is awaited.

Strengthened Design Resources Server

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

i) Online generation of balanced incomplete Latin square designs for all values of $3 < v < 21$ (except $v = 6, 10, 14, 18$) at www.iasri.res.in/design/BILS_Design/Default.aspx. A balanced incomplete Latin square design with parameters v and r is an incomplete Latin square of order v

such that each row and each column has $r < v$ non-empty cells and $v - r$ empty cells and each of the v symbols appears exactly r times in the whole square. Henceforth, we shall denote a balanced incomplete Latin square with v symbols and r replications of each symbol as BILS (v, r).

ii) On-line generation of Row Column Designs with equal replication of each treatments for Factorial Experiments in Two Rows for 2^n (n<10) factorial experiments for orthogonal estimation of main effects and two factor interactions. Here, for each factor, two designs are generated, one in which main effects are estimated with more efficiency. Online generation module also generates designs with unequal replications in the same parametric range for orthogonal estimation of main effects and two factor interactions. Here one can obtain designs with fewer numbers of columns as compared to the minimum number of replications required for orthogonal estimation of main effects and two factor interactions in equi-replicated designs. It is made available at http://www.iasri.res.in/design/Row_Column_design_OP_2_rows/Default.aspx.

iii) Bibliography on Response Surface Designs at http://www.iasri.res.in/design/Response%20Surface/RS_Home.html.

Usage of the Server

- The server has a facility of "Ask a Question" through which a lot of questions are being received and answered. More than 50 questions asked during this period through link 'Ask a Question' were answered for providing e-advisory services. During April 01, 2015 - March 31, 2016, Google analytics gave 11,561 page views through 466 cities of 102 countries. Average time taken on page is 3.19 minutes.

Strengthened Sample Survey Resources Server

- For providing e-advisory and e-learning in sample surveys strengthened Sample Survey Resources Server (http://sample.iasri.res.in/ssrs/) as a team member by adding links on (i) bibliography on Non-sampling errors; (ii) History of Statistics on Timeline and (iii) MAPI a mobile Application for Android OS for data collection.

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

Mapping the Cultural Authority of Science across Europe and India (MACAS-EU & India 2012-14)

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

A Study on STAR and SV Families of Nonlinear Time-series Models for Describing Cyclicity and Volatility in Agriculture

The estimation of parameters of STAR family of models through a powerful optimization technique of PSO is described. It is suggested that, for modelling and forecasting of cyclical time-series data, researchers should make use of this model rather than the ARIMA model. As future work, effort can also be directed towards considering more parsimonious STAR models.

Further, a model to capture both the cyclicity as well as volatility phenomena is proposed. The methodology for fitting the model is developed. The methodology developed is illustrated by applying it to two data sets that have both cyclical as well as volatile characteristics. It is advocated that, for analysing the time-series data that show these two phenomena, researchers and econometrician should apply this model rather than the ARIMA model as the proposed methodology is performing better than ARIMA from both modelling and forecasting point of view. Further, ARIMA model is not able to capture the cyclical and volatile feature in the dataset satisfactorily. Finally, possibility of application of other combinations of nonlinear models for capturing the characteristics of real-life data may be explored.

Subsequently, for the volatile datasets which has missing observation, the EM algorithm in conjunction with Particle filter was applied to estimate the parameters of Stochastic Volatility (SV) model. It was seen that SV model is found to be reasonably good for modelling as well as forecasting purposes. It is hoped that agricultural scientists would start employing SV methodology for modelling and forecasting of their volatile datasets.

A Study on Price Efficiency in Agricultural Commodity Market

The results of Error Correction Model for Indore market for Soybean revealed that basic requirement of an ECM is at least one coefficient i.e α or β must be non zero. This condition has been fulfilled in Indore Spot market. The coefficient α_f (in three contracts) and β_f (in one contract) are statistically significant, which implied that spot price has casual relation with futures price in one contacts. The coefficients β_s and β_f either both or at least one found to be significant in three contracts. This statement signifies the facts that better price were discovered only in these future contracts. The results reveal that there is causality from future to spot in most of the contracts i.e., future market leads the spot market. The results of Error Correction Model for Soybean in Kota market showed that the value of α_s remained positive in the two contracts. The same statement holds valid for future market in the three future contracts. The coefficient α_s and β_s are statistically significant in two and one contracts respectively whereas insignificant in others, it implies that the future price has casual relation with spot price only in those contracts. The price discovery, the coefficients β_s and β_f either both or at least one found to be significant in only one contracts. This statement signifies the facts that better price were discovered only in this future contracts. The results also reveal that there is causality from future to spot in most of the contracts i.e., future market leads the spot market. The results of Error Correction Model for Nagpur market revealed that the value of α_s remained positive in the two contracts which is the basic requirement of an ECM. The coefficient α_f (in all the five contracts) and β_f (in three contract) are statistically significant, which implied that spot price has casual relation with futures price in these contacts respectively. In terms of price discovery, the coefficients β_s and β_f either both or at least one found to be significant in four contracts. This statement signifies the facts that better price were discovered only in four future contracts. The results also reveal that there is causality from future to spot in most of the contracts i.e., future market leads the spot market. The results of threshold cointegration suggest that, soybean futures price governs most of the adjustment from the short run to the long run equilibrium of the model because its coefficients for ω_{t-1} are highly significant (-1.380 and -1.051 in the first and second regime respectively). The error correction coefficients also indicate that magnitude of response of soybean futures price is much higher as compared to the coefficients of spot price and future prices exhibit strong error correction effects on both side of the estimated threshold. So we are able to confirm that the soybean futures price leads the price behavioral pattern of the spot price. The result also tells us that the dominant regime is the first regime (typical regime) though extreme regime also contains 38.1 percent observations which fall in this regime. The results also confirmed with the presence of dynamic price behavior pattern for both Δf and Δs in first regime but absent in the extreme regime. The result shows that the value of Δf and Δs are close to white noise in the second regime indicating drift less random walk.

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

Time series data on rice yield has been collected from Directorate of Economics and Statistics (from website as well as publications) from 1970 to 2013 for Aligarh and Varanasi districts of Uttar Pradesh. Weather data like minimum temperature, maximum temperature and rainfall have been taken from IMD for the corresponding districts as well as years. Linear times series method was applied on the yield data. Linear time series method was applied on the rice yield data. On the basis of goodness of fit criterion and diagnostic checks, we selected ARIMA (1,1,0) for yield data. Using the selected model, forecast of yield of rice were obtained with residuals by 2013. Nonlinear autoregressive approach was applied on the residuals obtained by ARIMA (1,1,0). We tried 10 models with the combinations of different time delays and hidden nodes and finally selected the model with 01 time delay and 4 hidden nodes with minimum RMSE (0.031). Using this model (1:4s), we got improved fitted values of residuals obtained by ARIMA (1,1,0) and eventually, we got improved fitted values of yield along with improved residuals. Computed MAPE for ARIMA (1,1,0) and Hybrid ARIMA are found to be 18.13% and 11.62%, respectively, clearly showing better performance of hybrid approach than the linear times series alone. Improvement of residuals using support vector machine is in progress.

Study on Volatility Spillover of Agricultural Commodity Prices

During this period the study has been conducted on monthly wholesale prices of onion of Mumbai, Nashik, Delhi and Bangalore markets collected from the website of *agmarknet.nic.in*. For analysis purpose R software as well as MATLAB software has been used. At the beginning, presence of seasonal effects has been checked for each market price and accordingly seasonal adjustment has been done. To test stationarity of individual market price Augmented Dickey Fuller (ADF) test has been applied. The proper order of univariate Generalized Auto Regressive Conditional Heteroscedastic (GARCH) model has been identified for every series to measure volatility pattern of each market price.

Suitable Vector Autoregressive (VAR) model order has been identified using proper lag selection criteria such as Final Prediction Error (FPE), Akaike Information Criteria, Hannan-Quinn Criterion (HQ), Likelihood Ratio (LR) test. The Johansen cointegration test has been performed to check whether the market pairs are cointegrated. After that appropriate Vector Error Correction Model (VECM) has been formulated for every market pairs.

To investigate, volatility spillover among those prices, multivariate GARCH models viz. Baba-Engle-Kraft-Kroner (BEKK) and Dynamic Conditional Correlation (DCC) model has been employed. The methodology has been further extended to the semiparametric approach in which Nadaraya-Watson estimation technique has been applied to obtain the estimator of semiparametric conditional covariance matrix.

Further, a new innovative approach using Radial Basis Function (RBF) neural network combined with genetic algorithm has been applied to understand the nature of volatility spillover among the onion markets.

Forecasting of Spatio-Temporal Time Series Data using Space Time Autoregressive Moving Average (STARMA) Model

All India maize yield (kg/hectare) data from 1950-2013 was collected from Agricultural Statistics at a Glance, 2014, DES, Ministry of Agriculture and Farmers Welfare, GOI. The data from 1950-2003 was used for ARIMA model building and the reaming ten year data was defined from 2004-2013 was used for model validation. For parameter optimization using GA, the Objective function in terms of fitness function by minimizing the difference between actual and the estimated values. For GA the population size of 250 was selected based on Roulette wheel selection method with selection rate 60%. The result revealed that the ARMA-GA approach can provide reasonable results compared to the other well-known methods. The GA minimizes the error in the parameter estimation and provides excellent results for parameter estimation compare to other methods.

Non-parametric Bootstrap Approach for Constructing Prediction Intervals for Non-Linear and Bivariate Time Series Models

One real data set was taken and fitted employing VAR model and the residuals of the fitted model was tested employing MVN test. Bootstrap algorithm for constructing prediction interval in VAR model has been developed. Out of sample forecasting code for ANN is developed in Matlab software.

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

Study on Improving Methods for Estimating Crop Area, Yield and Production Under Mixed, Repeated and Continuous Cropping

This project was awarded to ICAR-IASRI by Food and Agriculture Organization of the United Nations (FAO) under the "Global Strategy to Improve Agricultural and Rural Statistics" of FAO. For estimation of crop area and yield under mixed and continuous cropping, sampling methodologies have been developed for different situations prevailing in different countries. Three different approaches namely, (i) Cadastral map based approach, (ii) Area Frame approach and (iii) Household approach have been proposed under this study. Technical Report-1 on "Synthesis of Literature and Framework" and Technical Report -2 on "Gap Analysis and Proposed Methodologies for Estimation of Crop Area and Crop Yield under Mixed and Continuous Cropping" were submitted and both the Reports were accepted and published by the FAO. Field Test Protocol (FTP) document was also prepared and submitted to FAO, and is also accepted for publication. Presentations on Technical Report-1, Technical Report-2 and FTP were made in the Expert Group Meeting and in Scientific Advisory Committee (SAC) meeting.

The developed methodology is being field tested in the three identified countries by the FAO, one each in Asia-Pacific, Africa and Latin America/Caribbean region, i.e. Indonesia, Rwanda and Jamaica respectively. Questionnaires were designed for

primary data collection on crop area and crop yield for developed alternative methodologies proposed under three different approaches and Instruction Manuals for filling up the questionnaires were also prepared for all the three approaches. Class room training as well as field training for filling up schedules and different methods of conducting Crop Cutting Experiments was imparted by ICAR-IASRI officials to the Enumerators, Supervisors/Master trainers and nominated officials in all the three countries. Primary data collection is in progress in Indonesia, Rwanda and Jamaica using Computer Assisted Personal Interviewing (CAPI) and Paper Assisted Personal Interviewing (PAPI) methods.

The questionnaires developed for primary data collection in Indonesia have been designed using CAPI designer and are being designed for Rwanda and Jamaica. In-house server at ICAR-IASRI has been set up and configured for the CAPI software and the data from the field is being uploaded by the Enumerators/Field Investigators of Indonesia to the ICAR-IASRI server dedicated for this purpose and will be uploaded by the enumerators of Rwanda and Jamaica shortly.

Training imparted in Indonesia by ICAR-IASRI Officials.

Training imparted in Rwanda by ICAR-IASRI Officials.

Training imparted in Jamaica by ICAR-IASRI Officials

Study to Test the Developed Alternative Methodology for Estimation of Area and Production of Horticultural Crops: IASRI Component of CHAMAN Project under MIDH

This project is funded by Department of Agriculture, Cooperation and Farmers Welfare (DAC&FW), Ministry of Agriculture and Farmers Welfare (MoA&FW), Govt. of India. The project is approved under Coordinated Programme on Horticulture Assessment and Management using GeoiNformatics (CHAMAN) Project of DAC under Mission for Integrated Development of Horticulture (MIDH). The ICAR-IASRI has been declared as National Level Agency (NLA) under MIDH for taking up this study.

Testing and validation of methodology for estimation of area and production of horticultural crops developed by ICAR-IASRI is being carried out in six states of the country namely, Tamil Nadu, Andhra Pradesh, Karnataka, Maharashtra, Himachal Pradesh and Gujarat.

Request for Proposal (RFP) document for hiring Field Investigators in the states through an agency, Schedules and Instruction Manuals (English and Hindi version) for primary data collection were prepared and sent to the states along with list of selected blocks/mandals/taluks and villages for all the selected districts. Class room training as well as field training for filling up schedules and different methods of conducting Crop Cutting Experiments in case of horticultural crops were imparted to the hired FIs/nominated staff as well as Master trainers (State officials) by ICAR-IASRI officials in four states. Data collection work is in progress in Andhra Pradesh,

Training imparted in Himachal Pradesh by ICAR-IASRI Officials

Training imparted in Tamil Nadu by ICAR-IASRI Officials

Training imparted in Andhra Pradesh by ICAR-IASRI Officials

Training imparted in Maharashtra by ICAR-IASRI Officials

Himachal Pradesh, Maharashtra and Tamil Nadu. The schedules developed for primary data collection are being designed using CAPI (Computer Assisted Personal Interviewing) designer. Development of data entry and data analysis software is in progress. Infrastructure report on Organizational structure and man power requirements, their role and functions along with budget requirement for implementation of this methodology in all the states of the country from 2017-2018 onwards was prepared and submitted to the funding agency.

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

This project is funded by Directorate of Economics & Statistics (DES), Ministry of Agriculture and Farmers Welfare (MoA&FW), Govt. of India. Sampling methodology of crop area and production has been finalized. The study is being conducted in four states namely, Uttar Pradesh, Karnataka, Odisha and Assam.

For area enumeration 100 survey numbers have been selected in each selected village by selecting 20 clusters randomly consisting of 5 survey numbers within each cluster. For estimation of yield rates crop cutting experiments were to be conducted for two major crops in Kharif season and one major crop in Rabi season with two CCEs for each crop in each selected village.

In these states, field data collection work during Kharif season of Agricultural Year 2015-2016 has been completed and data entry is in progress at State head quarters of respective states. For Rabi season, data collection for area enumeration has been completed and conduct of CCEs for estimation of yield is in progress. Data collection work in Gujarat State will be carried out for Agricultural Year 2016-2017. A Mobile Assisted Personal Interviewing (MAPI) Software has been developed for the data collection work and implementation of MAPI software in the Uttar Pradesh State has been initiated.

Pilot Study for Estimation of Seed, Feed and Wastage Ratios of Major Food Grains

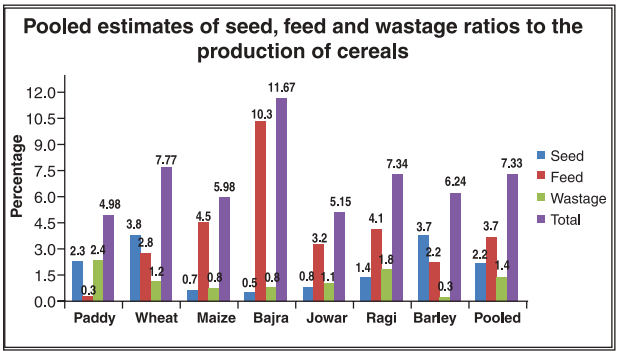
A netting factor of 12.5 per cent is being used to account for seed, feed, and wastages ratios to the food grains production in the country since 1960's. Since this factor of 12.5 per cent is based on much older norm, doubts have been raised from time to time necessitating re-examination of the basis for

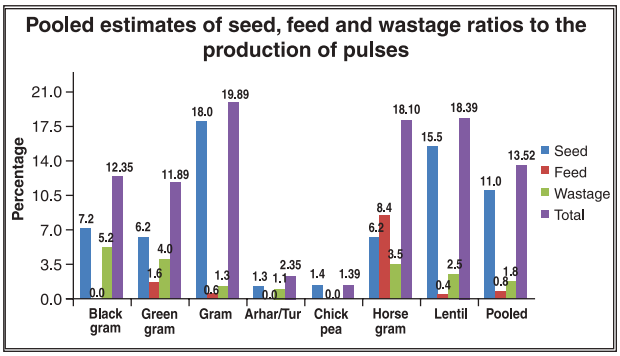
this conventional figure. The estimates of seed, feed and wastage ratios of major food grains viz. paddy, wheat, maize, bajra, jowar, ragi and barley has been relooked and recomputed. Pooled estimates of seed, feed and wastage ratios to the production of all cereals were to the tune of 2.182%, 3.724% and 1.419% respectively with total of 7.325%. Black gram, green gram, gram, arhar/tur, chick pea, horse gram and lentil are the major pulses grown in the selected districts of five states under study. Pooled estimates seed, feed and wastage ratios to the production of all pulses were to the tune of 10.985%, 0.758% and 1.781% respectively with total of 13.524%. Pooled estimates of seed, feed and wastage ratios to the production of all food grain crops grown in the selected states were to the tune of 3.148% for seed, 3.399% for feed and 1.459% for wastage with a total of 8.005%.

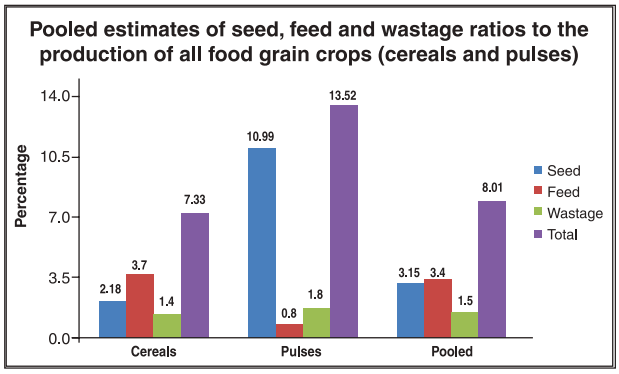
It indicates that over-all ratios has gone down by 4.5% approximately as compared to the ratios (12.5%) used since long for estimating the total availability of food grains for human consumption in the country. These developed seed, feed and wastage ratios to the production of major food grain crops are of immense use for planning and formulation of future policies by the Government and policy makers for the economic development of the country.

It may be noted that pooled estimates of seed, feed and wastage ratios to the production of all the major food grain crops are based on pilot study conducted in five states under study by taking four districts from each state. It is therefore, recommended that a large scale survey need to be conducted for developing the estimates of seed, feed and wastage ratios for adoption as standards.

The new seed, feed and wastage ratios to the production of food grain crops developed are of immense use for planning and formulation of future policies by the Government and policy makers for the economic development of the country.







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

As per availability of complex auxiliary information (Särndal *et al.* 1992) under two stage sampling design the following three cases were considered:

Case A: Population level complete auxiliary information is available at the primary stage unit (PSU) level.

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

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

Under two stage sampling design with assumption that the auxiliary variable is inversely related to study variable, three different calibration based product type estimators for estimation of population total along with their approximate variance and the Yates-Grundy form of estimate of variance have been developed. Usual product estimators for estimation of population total under all cases in two stage sampling design were compared with the proposed calibration approach based product type estimator. On the basis of the correlation coefficient between study and auxiliary variable, criteria of superiority of the proposed calibration based product type estimators with respect to usual product estimators of population total have been obtained.

A simulation study has been carried out in order to empirically evaluate the statistical performance of proposed calibration based product type estimators. Simulation results suggest the superiority of proposed calibration based product type estimators with respective usual product estimators of population total on the basis of percent Relative Bias (%RB) and percent Relative Root Mean Square Error (%RRMSE).

Different product type calibration estimators have been developed on the basis of two phase sampling for the situation when there was unavailability of auxiliary information under two stage sampling design. The two-phase or double sampling approach is useful when the information on the auxiliary character is not known at the population level and this information is to be collected by selecting a larger sample, observing the auxiliary character, and further sub sampling of the larger sample to observe the study character (Estevao and Särndal 2002).

For this situation two cases were considered, Case 1: The population level auxiliary information is unavailable at the PSU level and Case 2: The population level complete auxiliary information is unavailable at the SSU level have been considered. Under both the cases, two different product type calibration estimators have been developed using two phase sampling approach under two stage sampling design. In addition, the variance and estimate of variance of the product type calibration estimators have been developed considering equal probability without replacement design (SRSWOR) at different stages and phases of sampling.

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

Fay Herriot model is widely used area level model for Small Area Estimation (SAE). The area level models are used for SAE when auxiliary information is available only at area level. They relate small area direct survey estimates to area-specific covariates, often obtained from various administrative and census records. In many applications these area level models are fitted on transformed scale. Under this study, focus is on commonly used logarithm (log) transformation. In small area literatures, log transformed Fay Herriot model is frequently employed when data are non-linear on original scale. In this case, Fay Herriot model is fitted on log of direct survey estimates and model parameters are estimated under this model. Then back transformation is used to obtain the estimate for small area quantities on original scale. However, back transformation leads to biased estimates of small areas on original scale. Slud and Maiti (2006) described SAE under log transformed Fay Herriot model. Their predictor for small areas accounts for area specific effects but does not take into account the variability due to parameter estimates. A bias-corrected predictor for small area quantities under log transformed Fay Herriot model has been developed. The empirical results based on simulation studies show that the proposed predictor has smaller biases and better efficiency as compared to the alternative predictor.

Testing and Validation of Alternative Methodology Developed by IASRI for Estimation of Area and Production of Horticultural Crops in Madhya Pradesh State

District-wise data on area and production of horticulture crops for the year 2012-2013 was obtained from Division of Horticulture, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India. The proposed sampling design to be adopted for the survey is stratified multistage random

Training imparted in Madhya Pradesh by ICAR-IASRI Officials

sampling. On the basis of district-wise area figures under fruits and vegetables of the State, selection of districts was carried out as per proposed sampling design. Block-wise data on area under horticultural crops of the selected districts for the year 2012-2013 was obtained from the State Govt. Selection of blocks and villages within selected blocks was carried out as per proposed sampling design.
Request For Proposal (RFP) document for hiring Field Investigators in the State through an agency, Schedules and Instruction Manuals (English and Hindi version) for primary data collection were prepared and sent to the State along with List of selected blocks and villages for all the selected districts. Class room training as well as Field training for filling up of schedules and different methods of conducting Crop Cutting Experiments for horticultural crops were imparted to the nominated State Govt. staff as well as Master trainers (State Headquarter officials) in the State by ICAR-IASRI officials. Data collection is being carried out.

Testing and Validation of Alternative Methodology Developed by IASRI for Estimation of Area and Production of Horticultural Crops in Haryana State

District-wise data on area and production of horticulture crops for the year 2012-13 was obtained from Division of Horticulture, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India. The proposed sampling design to be adopted for the survey is stratified multistage random sampling. On the basis of district-wise area figures under fruits and vegetables of the State, selection of districts was carried out as per proposed sampling design. Tehsil-wise data on area under horticultural crops of the selected districts for the year 2012-13 was obtained from the State Govt. Selection of tehsils and villages within selected tehsils was carried out as per proposed sampling design.
Request for Proposal (RFP) document for hiring Field Investigators in the State through an agency, Schedules and Instruction Manuals (English and Hindi version) for primary data collection were prepared and sent to the State along with List of selected tehsils and villages for all the selected districts. Process of selection of Service Providers is completed and 42 FIs have been hired. Class room training as well as Field training for filling up of schedules and different methods of conducting Crop Cutting Experiments for horticultural crops will be imparted to the hired FIs as well as master trainers (State officials) by ICAR-IASRI officials shortly. Detailed survey work in the State will be carried out in Agricultural Year 2016-2017.

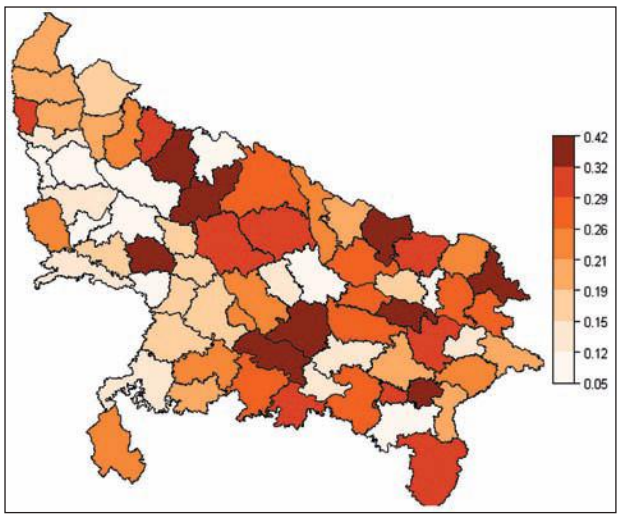
An Investigation of Causes of Divergence between Official and Trade Estimates of Jute Production

Extensive review has been done related to cultivation of jute crop, States and districts in which jute is grown, practices followed for growing jute, varieties grown in various states, state-wise and district-wise area and production of jute, the methodology being followed for estimation of production of jute etc. Three states West Bengal, Bihar and Assam have been identified and four districts have been selected in each state on the basis of maximum area and production under jute crop. Attempt is being made to acquire Crop Cutting Experiment (CCE) data on jute and methodology being followed by Jute Advisory Board (JAB) from the respective agencies. Attempt will be made to re-analyse the data after its acquisition from the states under study.

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

There is a growing need for current and reliable count data at small domain or small area level. The empirical predictor under a generalized linear mixed model (GLMM) is often used for small area estimation of such data. However, GLMM assumes that the fixed effect parameters are spatially invariant and does not account for the presence of spatial nonstationarity in the data. Geographically weighted regression concept is considered to extend the area level version of GLMM to take into account for spatial nonstationary and then to use it in small area estimation. In particular, the empirical predictor for small areas under a spatial nonstationary version area level GLMM (NSEP) is proposed. Two approaches for estimating mean squared error for the NSEP, an analytical MSE and a parametric bootstrap approach are also developed. A parametric bootstrap approach based diagnostic procedure for presence of spatial nonstationarity in the count data is also developed. Empirical results based on simulation studies show that the proposed NSEP provides efficient estimates for small areas as compared to existing methods when spatial nonstationarity is present in the data. Developed MSE estimators provide satisfactory performance. In particular, analytical MSE estimator has smaller bias but bootstrap MSE estimator is slightly more stable. Proposed small area estimation method is also

applied to obtain reliable estimates of proportion of poor households at district levels in the State of Uttar Pradesh by using survey data from the Household Consumer Expenditure (HCE) Survey 2011-2012 of National Sample Survey Office (NSSO) 68th round and the Population Census 2011. Subsequently, a poverty map for State of Uttar Pradesh is produced which provides an important information for analysis of spatial distribution of poverty in the State.



District wise poverty map for the State of Uttar Pradesh

Study to Develop an Alternative Methodology for Estimation of Cotton Production

An operating manual entitled "Operating Manual for implementation of Alternative sampling methodology for estimation of cotton production using double sampling approach" for implementation of the newly developed methodology under the project in cotton growing states of the country was prepared. Training was imparted to the officials/Master trainers of the cotton growing states of the country for implementation of the newly developed methodology. The newly developed alternative methodology using double sampling approach has been implemented by DES, Ministry of Agriculture & Farmers Welfare, Govt. of India in all the cotton growing states of the country w.e.f. 2015-2016. The official estimates of cotton production from 2015-2016 onwards will be released using the newly developed alternative methodology.

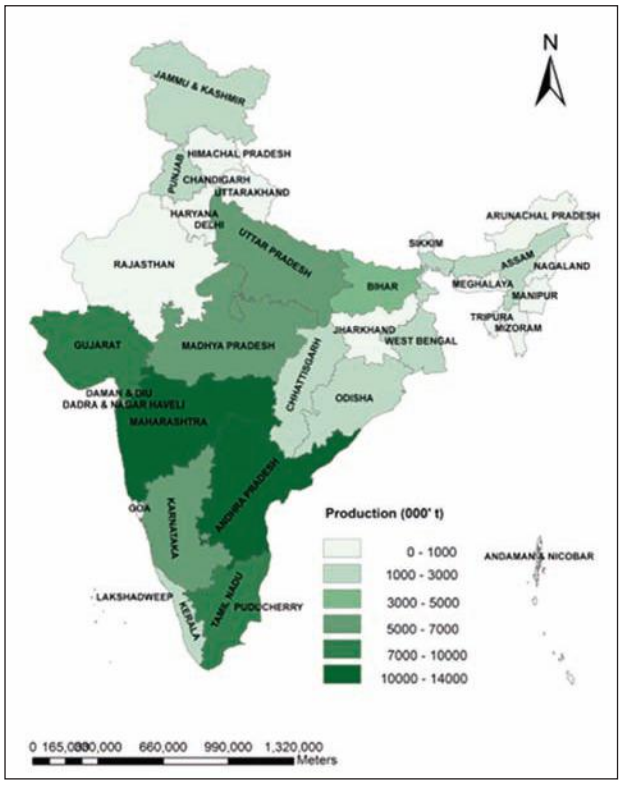
Method of Sampling of Imported Fertilizers from Ships, Containers and Baggage

A Technical Sub-Committee was constituted to examine the methods of sampling and analysis. Suggested changes in the methods of sampling of imported fertilizers from ships and containers have been accepted by the Govt. of India. The modified method of sampling of imported fertilizers from ships and containers is adopted and is included in Fertilizer Control Order (FCO), Govt. of India published in 2015. Sampling procedure from bagged fertilizer under different conditions, as prescribed under Schedule B Part A of Fertilizer (Control) Order, 1985 was discussed at length and its modified method under different conditions such as at fertilizer manufacturing units, rake points, warehouses/ godowns, dealers etc. needs to be suggested for inclusion in Fertilizer Control Order (FCO), Govt. of India.

Agricultural Research Data Book (ARDB)

Information pertaining to agricultural research, education and related aspects available from different sources is scattered over various types of published and unpublished records. The first ARDB was brought out in the year 1996 and the current Agricultural Research Data Book (ARDB) 2015, which is the Eighteenth in the series, is an attempt to put together main components/indicators of such information. The Data Book comprising of 151 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 the latest information / data as available in the country by the end of June, 2015. The information has been collected and collated on various aspects of agriculture for use by diverse stakeholders of the Council such as the policy makers; scientists; extension workers; students and researchers; entrepreneurs and industry; progressive farmers, etc.

In ARDB 2015, some value additions like predicting the future year production of food grain crops etc., based on previous years data using statistical models, pictorial/graphical representations of data have been done. For depicting state-wise data, thematic maps have been prepared using Geographical Information System (GIS). Efforts have been made to incorporate the comments and suggestions received from various users.



State-wise production of fruit crops during the year 2013-14

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

A Study on Modelling and Forecasting of Time-Series with Long Memory Processes

High frequency financial time-series of returns are often characterised by having excess kurtosis and autocorrelated squared observations. Moreover, these autocorrelations tend to decay very slowly, suggesting that squared returns could be characterised as a long memory process. This property is best described in Long-Memory Stochastic Volatility (LMSV) model. Daily time series data for spot prices of gram in Delhi Market during 1 January, 2009 to 31 July, 2013 was taken for application of LMSV model. The return series were computed as differences in log prices. The data was collected from Ministry of Consumer's Affairs, Government of India. The data for the period January 1, 2009 to June 30, 2013 was used for model building and the remaining data was used for model validation. It was found that both the returns as well as squared return spot price series data are stationary. We applied the GPH tests for testing long memory to the return and squared returns of the spot prices of gram. For the return series, the test showed no evidence of LM patterns; as the null hypothesis of no persistence was not rejected. The result for squared return was different from that of the returns. Indeed, long memory property was found to be highly significant for the squared returns. Since squared returns are a good proxy for volatility, these findings thus suggest that the conditional volatility of return would tend to be range-dependent, persist and decay slowly. Intuitively, this volatility persistence can be appropriately modeled by a LMSV process because it allows for long memory behavior and slow decay of the impact of a volatility shock. It is, however, important to note that the estimate of the LM parameter d is less than 0.5 for squared return indicating the stationarity of the process. To this end comparison of forecast performance between LMSV and FIGARCH models by using Diebold-Mariano (DM) test suggest the superiority of the former in terms of forecasting the price.

Development of Statistical Approach for Prediction of Eukaryotic Splice Sites

An attempt has been made to develop some computational approaches for the prediction of donor splice sites in eukaryotic species. Initially, the application of statistical techniques like position weight matrix, Pearson's Chi-square, modified Bhattacharya distance, Cramer's V coefficient was explored for determining a suitable window size in rice, maize and barley. In all these species, a window size of 9bp (3bp at the end of exon+6bp at the beginning of intron) was found to be optimum. Further, three computational approaches were developed for the prediction of donor splice sites, among which one is probabilistic approach and other three are machine learning-based approaches. In the probabilistic approach, sum of absolute error was computed for each candidate splice site sequence (vertebrate genome) by taking into account all possible di-nucleotide dependency into account, and the prediction was made based on a threshold value. In the *first* computational approach, the associations among the nucleotides were used to encode the splice site sequence, which were then used as input in machine learning classifiers like ANN, SVM and Random Forest. The performance of three approaches was compared with each other, where the Random Forest achieved higher accuracy than that of SVM followed by ANN. In the *second* computational approach, absolute error obtained for each nucleotide at each position (under probabilistic approach) was used to encode the splice site sequence into numeric form, which was further used in machine learning classifiers for prediction. The proposed approach was found to achieve an

acceptable level of accuracy that will complement the existing approaches. In the *third* computational approach, three different set of features were developed i.e., positional features, compositional features and dependency features. These features were used as input in SVM for the prediction of donor splice sites. This approach was tested on four different species *i.e.*, human, fish, bovine and worm, and achieved consistent accuracy over all the species. Based on the developed approaches, three web servers viz., *dSSpred* (http://cabgrid.res.in:8080/sspred), *PreDOSS* (http://cabgrid.res.in:8080/predoss) and *HSplice* (http://cabgrid.res.in:8080/hsplice) have also been developed for the prediction of donor splice sites. The developed web servers will be of great help for the biological community for easy prediction of donor splice sites.

Development of Methodology for Nonparametric Modelling of Time-Series Data and its Application in Agriculture

Nonparametric regression analysis in time-domain for modelling and forecasting of country's growth rate and production of agricultural commodities has been considered. The methodology for estimation of nonparametric regression function has been developed and applied under the set-up of correlated errors. This lends to obtain appropriate minimization criteria for the choice of data driven band-width under cross validation. This is based on criterion of minimizing squared error between observation at time and its stochastic conditional expectation given all other observations to minimize mean integrated square error for estimation of regression function. Another data-driven choice of bandwidth estimation is developed based on bootstrap technique. The methodologies are used while estimating the nonparametric regression function by moving averages and kernel smoothing of observations. Also, interval estimates are obtained for true regression function and prediction intervals are developed based on criteria of unconditional and conditional prediction error variance.

Development of Rank Based Stability Measures for Selecting Genotypes

Generally, ANOVA is not useful for qualitative, non-normal distributed data. Therefore it is required to have measures that do not require any parametric assumption. Therefore, an alternative measure is developed to quantify the magnitude of Genotype x Environment (GxE) interaction. Correlation of performance rank order of genotypes in one environment with others is used for this purpose. Average of these absolute correlation coefficients (excluding self) is used to prepare an index. This index is designated as IGEI. If IGEI value is near 1, it indicates that no GxE interaction is present and if IGEI is far from 1 then it indicates the presence of higher magnitude of GxE interaction.

For development of stability measure for selecting genotypes, the concept of rank variance stability measures based on rank of corrected observations as proposed by Nassar and Huhn has been used. This stability measure based on rank for selecting stable genotype has been developed by using rank sum (RS) of different genotype on the basis of rank of absolute interaction residual ($V_{ij} = (Y_{ij} - \bar{Y}_{i.} - \bar{Y}_{.j} + \bar{Y}_{..})$ and variance of each genotype ($S_i^{(2)}$) among the environment on the basis of interaction residual among all environments. Linear combination of stability ranks realized from RS and $S_i^{(2)}$ is proposed as a new stability measure and is denoted as rank based stability index (RSI). $RSI=(r_{RS}+ r_{Si(2)})/2$, where r_{RS} is stability rank based on rank sum measure and $r_{Si(2)}$ is stability rank based on variance. Genotypes are re-ranked on the basis of the proposed measure.

Estimation of Breeding Value Using Longitudinal Data

One data set have been applied to the developed methodology in presence of correlation structure for both random effects and error in LMM. For parameter estimation purpose the ECM algorithm was used. For this purpose an attempt has been made to reparametrised the autoregressive coefficient, to ensure the stationary in the data. Again the partial autocorrelation with one lag are estimated from the data, and then partial autoregressive coefficients are computed from partial autocorrelation coefficients. By using the partial autoregressive coefficients the autocorrelation are calculated, which were used to construct the correlated error structure in LMM. Computer program has been developed to calculate the Numerator relationship matrix for 105 animals. The additive genetic variance covariance matrix has been constructed and the estimates of fixed and random effects and their variances have also been derived. Computer program has been developed for estimation of variance components in Linear Mixed effect Model (LMM) in presence of both correlated random effects and error.

Modelling and Construction of Transcriptional Regulatory Networks using Time-Series Gene Expression Data

For the selection of informative genes under particular

stress condition, a gene selection technique has been proposed based on bootstrapping and support vector machine with recursive feature elimination (SVM-RFE). The statistical significance values (*p-values*) are assigned to the genes by using Wilcoxon signed rank test. Based on the *p-values* the informative genes are selected from the large gene pool. Then the selected genes are divided into gene modules by using weighted gene co-expression network analysis technique. The modelling and construction of module interaction network has been done by using earlier developed approach. These approaches have been successfully applied to study the aluminum (Al) stress response mechanism in soybean. The gene ontology enrichment analysis of the selected genes revealed the underlying cellular mechanism of Al stress response in soybean. For the identification of hub genes (highly interacting genes) in the genetic network, a resampling based technique was proposed, which the hubs and unique hubs were identified based on the statistical significance values (*p-values*). The performance of the proposed technique was compared with the existing technique and the results showed that former identified a less number of hubs as compared to later, which are in accordance with the scale free property of biological networks. Further, these techniques were applied to salinity and Al stress in rice and soybean respectively to study the underlying mechanisms of stress response. For both these crops, various hub genes and unique hub genes were also identified.

Gene Selection for Classification of Crop Gene Expression Data

Gene expression data of Arabidopsis and Rice for different stresses *viz.* bacteria, salinity, cold and drought was collected from NCBI GEO database. The raw data was pre-processed using RMA algorithm. A gene selection approach, Boot-MRMR was proposed by incorporating bootstrap in MRMR procedure. In this procedure, informative genes for different stress conditions were selected using the statistical significance values (p-values), which are calculated, based on a non-parametric hypothesis testing procedure. The performance of the developed approach was compared with 12 available feature selection techniques based on several criteria.

Estimation of Heritability under Correlated Errors

Theoretical derivations for estimation of heritability and means square error for correlated error in case of full sib model was obtained. SAS codes for data generation as well as heritability estimation for different correlation structure of errors (AR(1) and AR(2)) in case of half sib and full sib models have been developed. Estimates of heritability and means square error (MSE) are obtained for heritability values (0.1, 0.25 and 0.5) , for different sample sizes (100,200,500,1000) and different correlations values ranging from -1 to +1. It has been observed that if correlation increase from -1 to 0 by 0.1 interval the MSE are decreasing but if correlation increase from 0 to +1 by 0.1 interval, the MSE are increasing. For fixed effect in the case of correlated error the estimate of heritability and MSE are obtained for different parametric values for different sample sizes under different correlation values. It is noticed that in the presence of fixed effect, MSE values increases for increasing correlation value and decreases with increase sample size.

Network Project on Market Intelligence

Forecasts on different commodity prices by collaborating centres have been validated from time to time. The validation of price forecast has been done for the centres: PJTSAU, BHU, GBPUAT, IABM, IIHR, ICAR-NEH, JAU, JNKVV, KAU, OUAT, PDKV, SKUAST, UASB, YSPUH&F. The study has been undertaken to investigate the export volatility, identify the structural breaks and determine the short and long run relationships between onion export and domestic prices using cointegration and Granger causality test. The study is based on the monthly arrival data of five major regulated markets from three major onion producing states of India namely Azadpur from Delhi, Lasalgaon, Pune and Solapur from Maharashtra, Bangalore and Hubli from Karnataka along with the export price. After checking for presence of seasonal and nonseasonal unit root, suitable SARIMA model was selected for modelling the onion export based on minimum AIC and SBC values. In order to model the conditional heteroscedasticity as well as asymmetricity in the volatility, Exponential GARCH model was applied. The analysis of structural breaks in volatility clearly indicated situations of price shocks in 2007, 2010, 2011 and 2013, when onion prices went abnormally high and created disturbances in the markets. Johansen method of cointegration was applied in order to find out the linkages between domestic markets and export price and also among the domestic markets. It was found that prices in all markets share stable long-run relationship. Granger causality test revealed that all the major domestic markets of onion Granger cause export prices on one hand and export prices Granger cause prices in Delhi, Bangalore, Hubli and Solapur markets. The

above results are also supported by the impulse response function. Forecasts on different commodity prices by collaborating centres have been validated from time to time.

A study has been done to examine the structure and flow of trade among SAARC economies. The study has revealed that India alone accounts for 74 per cent of the agricultural exports from the region and 55 per cent of the agricultural imports of the region. Cotton, cereals, fish & crustaceans, and tea & beverages have emerged as the most exported commodities accounting for more than 50 per cent share of exports from SAARC countries to the world. Animal or vegetable fat, cotton and rubber are the most imported commodities by SAARC. India enjoys comparative advantage in exports of cotton, cereals, fish and tea, while Pakistan has a greater comparative advantage in export of cotton and cereals. A unidirectional causality has been observed between gross domestic product (GDP) and agricultural exports, whereas agricultural exports Granger cause GDP and not vice versa. A one-way causal relationship has also been observed between agricultural GDP and agricultural exports. This indicates that growth in agricultural exports has contributed to the overall and agricultural growth in India. The study has suggested that Indian trade policy environment needs to be made more favourable for attracting foreign buyers and making Indian exports competitive globally.

Network Project on Impact Assessment of Agricultural Research and Development

The instrumental variable technique has been applied for assessing the impact of mechanization on agricultural output. Agricultural credit has been used as an instrumental variable for mechanization. The other explanatory variables used in this study are number of agricultural labours, HYV seeds, irrigation, fertilizer and pesticides used. The reference period of the study has been taken from 1991-2011. It is found that there is a strong endogenety between agriculture mechanization and credit. Its impact has been found positive and significant on agricultural output.

Another study is undertaken to estimate the impact of crop insurance on the farm income in India by using 70th round data of NSSO. Only 5.8% of agricultural households insure their crops against possible crop loss. Majority of farming households avail crop insurance through institutional credit. Propensity Score Matching (PSM) method has been used to estimate the average treatment effect of crop insurance on farm output. Probit model has been employed to estimate the propensity scores. Two states namely Rajasthan and Gujarat were selected for the study. The percentage of insured farmers in these two states is around 14%. Most of the insured farmers were found among the borrowers who had borrowed credits from bank. The impact of insurance on farm output was found positive and highly significant. Therefore, there is need to enhance the flow of crop insurance to reduce or cover the risk factor in the production practices. Besides, an attempt is also being made to compute Total Factor Productivity (TFP) at district level in India using stochastic production function in panel data.

Stochastic Differential Equation Models and their Applications to Agriculture

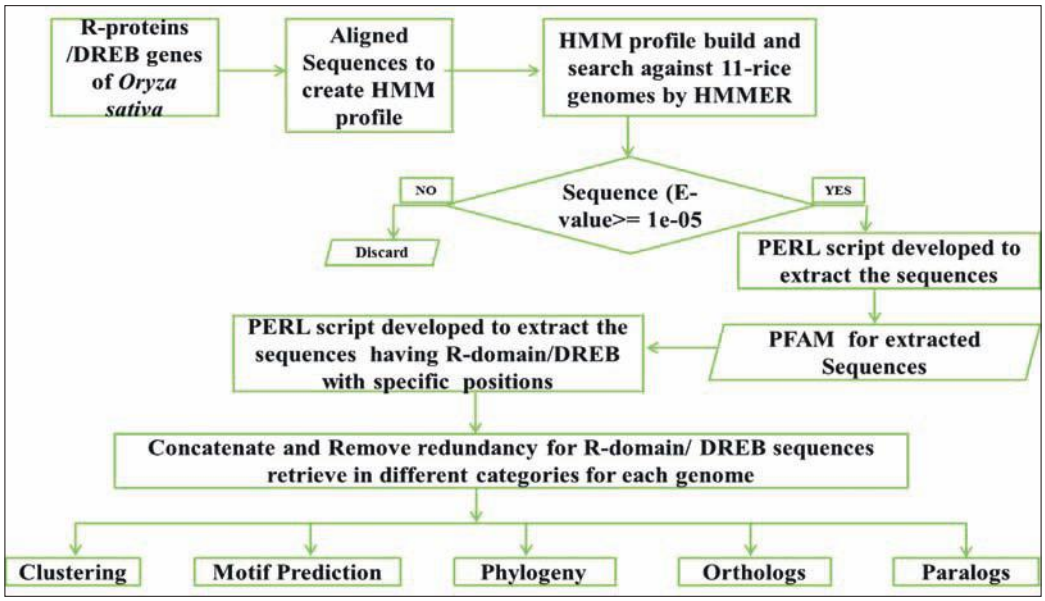
Literature survey of iterative and analytical solution of stochastic differential equations (SDE) has been carried out. Linear SDE model under random fluctuations and its various forms are considered for fitting growth data. It has been found that conditional distribution of solution of SDE with additive noise is Gaussian whose conditional distribution is homogeneous. Attempt has been made to obtain linear SDE with non-homogeneous transition probabilities. To this end, growth data on pig has been obtained and scrutinized. The data has been fitted using estimated SDE model obtained by maximum likelihood method.

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

Genes and promoters which are common across genotypes under specific stress, which can serve as robust candidates for crop improvement. Metadata analysis of rice R genes from 11 different Oryza species is standardized and carried out. Pipeline for Metadata analysis of rice R genes from 11 different Oryza species is standardized and carried out. Workflow is given below

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

Studying genomic variants play important role in breeding programmes. Detection of Single Nucleotide Variants spearing towards assigning genomic values to animals which is considered to be more realistic than breeding estimates. Confirmation of Indel, CNV, other regulatory systems, while, refining quality of buffalo genomic assemblies simultaneously is a firm foot-step towards subsequent genomic selection.



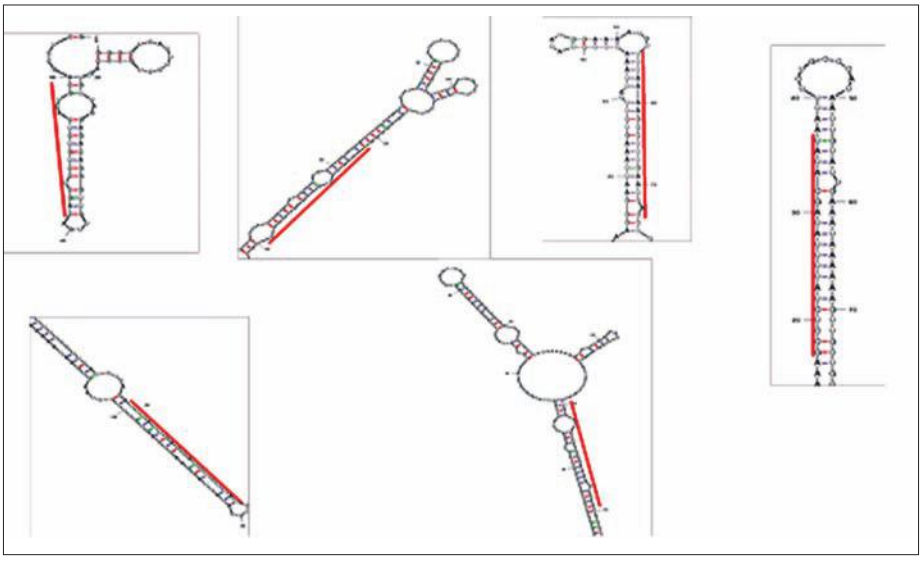
In order to identify regulatory elements, miRNAs in buffalo has been identified using *in-silico* approach. Total six miRNAs and their target genes have been identified based on Expressed Sequence Tag (EST) data. Structures of predicted miRNAs are given below

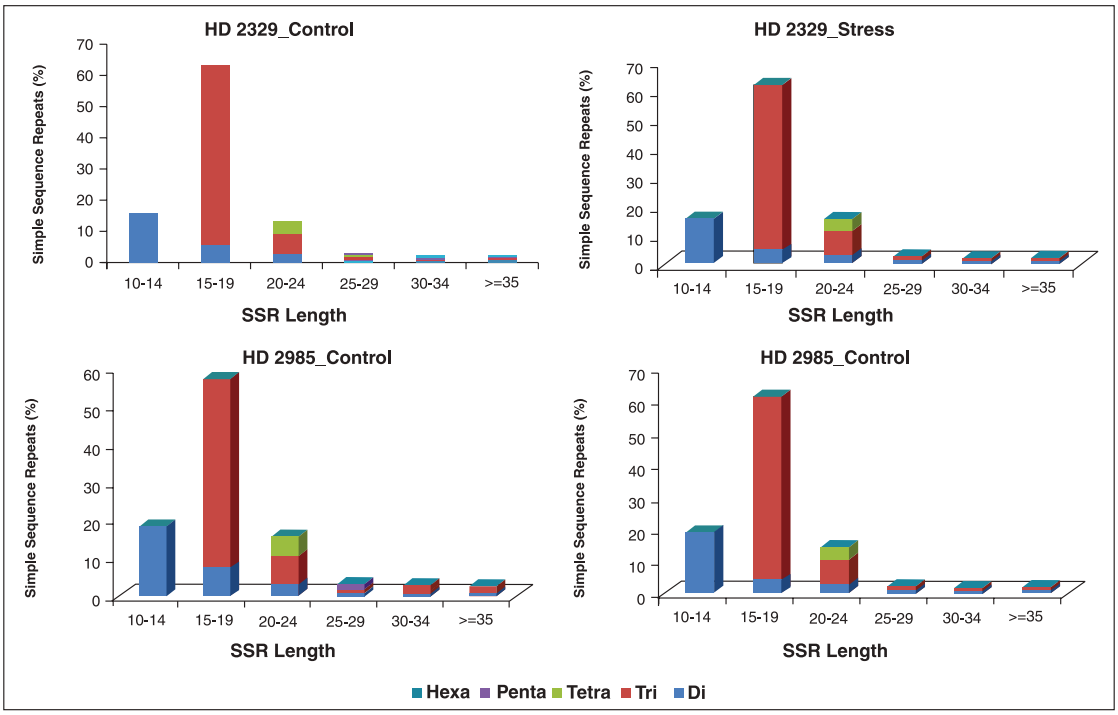
Gene Regulatory Networks Modeling For Heat Stress Responses of Source and Sink for Development of Climate Smart Wheat

In order to identify novel-heat stress responsive genes, transcriptome data analysis has been done which will be useful for understanding of stem reserve mobilization, photosynthetic heat tolerance and heat tolerance in grain development. Number of identified novel heat responsive genes related to various pathways is given below:

Novel Genes Associated with Source and Sink in Wheat under HS

Sample	Fructose Pathway	Search Motabolism	Sucross Motabolism
HD 29C1	62	60	51
HD 29C2	63	69	35
HD 29T1	42	48	35
HD 29T2	46	34	28
HD 85C1	80	41	34
HD 85C2	93	44	33
HD 85T1	78	58	33
HD 85T2	94	69	36





Apart from this, heat responsive candidate gene based SSR markers have also been identified which may be useful in mapping QTLs for heat stress tolerance in wheat. Bar diagram of distribution statistics of identified SSR markers are given below

Identification of Genetic Polymorphisms for Pathogenicity in Vibrio sp.

Bioinformatics research in brackishwater aquaculture is still in its infancy stage. There is ample scope for applying the bioinformatics tools and techniques in brackishwater aquaculture research to address important fish culture related problems. There is a need for genomic level studies on Vibrio sp. isolated from brackish water aquafarms, this will not only help in understanding the genetic variations but also in identification of the pathogenic factors. Finding such pathogenic factors will help in developing disease diagnostic kits. All the genomes (394) of Vibrio parahaemolyticus were downloaded from NCBI. rRNA prediction was done by rnammer. The multilocus sequence typing (mlst), phylogenetic analysis, ORF finding, identification of gene clusters was also done.

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

Enormous amount of whole genome and transcriptome sequence data are now either being generated regularly under various research projects or are available in public domain for a wide range of plant species. These data can be mined for allelic information that can be gainfully utilized in crop improvement programmes as well as several biotechnological applications. This will also help in enhancing the availability of knowledge on genes/ alleles of plant genetic resources partially of local origin and diversity. The work is in progress for preparation of a standalone database to help in functional annotation.

Computational Approach for Harnessing Genome Information and its Integration with Wheat Phenome for Efficient Varietal Development

Wheat coreset germplasm database for variety differentiation, all the 38 DUS feature data of 375 wheat coreset varieties and 192 AVT (Advance Varietal Trial) lines were compiled to develop the database. For SNP based variety differentiation, SNP data were generated using 35 K affymetrix chip over 375 core set wheat varieties and 192 AVT lines. Data was received and quality check has been done.

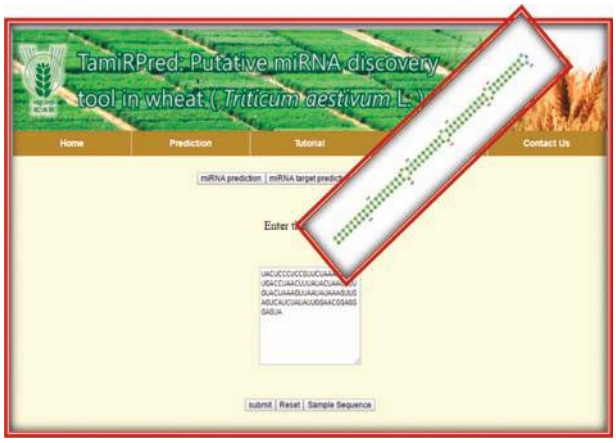
Biological and technical replicates for transcriptome data generation were finalized. Since transcriptome analysis of biotic and abiotic stress is targeted to decipher list of DEGs (differentially expressed genes) which is to be used in variety development thus extensive marker discovery was done by mining SSR markers. This was achieved using latest wheat genome assembly *T. aestivum* (2*n* = 6*x* = 42, AABBDD), was downloaded from Ensemble (http://

plants.ensembl.org/info/website/ftp/index.html). A total of 476169 SSRs were mined from genome A, B and D.

Availability of whole genome sequence and *in silico* approaches has revolutionised the bulk marker discovery. Here, we report world's first wheat whole genome marker discovery and database, WHMDb (http://webapp.cabgrid.res.in/whmdb/) with 476K markers unified in a common platform using MySQL, Apache and PHP. The embedded markers and corresponding location information can be selected as per desired chromosome desired location/ interval and primers can be generated using Primer3 core, integrated at the backend.

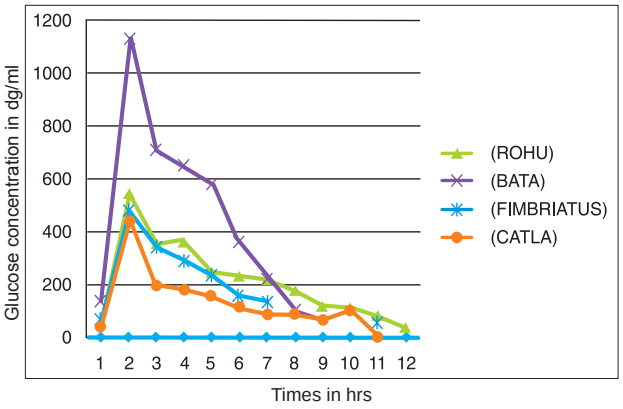
The objective of biotic (stripe rust) and abiotic stress (thermal heat tolerance) transcriptome analysis is expected to generate data on DEG and also discovery of micro RNA and isoforms. For system biology approach till transcriptome data is generated, the present assembly has been analyzed for mining of putative micro RNA. Filtered out the 159052 pseudo miRNA precursors, sequences with stem length between 20-50 nt, GC Content between 24-82 %, MFE between -20 to -60. For machine learning approach, 152 features were selected using miPlantPremat (http://www.biomedcentral.com/content/pdf/s12859-014-0423-x.pdf) for each sequence. Finally, 109 features were selected for micro RNA model development in wheat. In order to predict real miRNA precursor, model was developed using 108 known mature wheat miRNA sequences as positive set and 108 negative sequences (sequences extracted from coding sequences of wheat genome). Both ANN and SVM methodology was used for prediction. SVM with RBF karnel function gave best result with sensitivity, specificity, accuracy and MCC as 94.83, 97.41, 96.12 and 0.92 respectively. Total of 22,017 candidate sequences were identified as real miRNA precursors. To predict mature miRNA, model was also developed using Random Forest technique using WEKA tool with 102 features. Finally testing of 22,017 candidate precursor sequences, 7187 mature miRNA were obtained and database was created.

For miRNA target prediction, mature miRNA sequence and the wheat coding sequence are used as an input for miranda software (http://cbio.mskcc.org/tools/microrna/index.html). The output of miranda was parsed using in house perl scripts and linked to NCBI website. Finally a miRNA prediction and target identification tool has been also been developed (http://webtom.cabgrid.res.in/tamirpred).



Molecular and Computational Approach to Delineate Metabolic Pathways for Better Carbohydrate Utilization in Labeo spp.

In order to study transcriptome profile of two species of Rohu fish genus, *Labeo rohita* and *Labeo bata* and why the later one is high utilizer of glucose, different tolerance levels were estimated at various glucose concentration along with hormonal assay (insulin and glucagon) and enzymatic assay (glucokinase and hexokinase) before obtaining the right experimental tissues from these fish species. Total 40 sets of transcriptomic data were generated from four experimental treatments at different glucose concentration (100mg/ml to 400 mg/ml), taking five tissues viz., brain, liver, intestine, kidney and muscles in duplicate along with control. Transcriptomic NGS data generated (using illumina chemistry) were received and quality check was done.

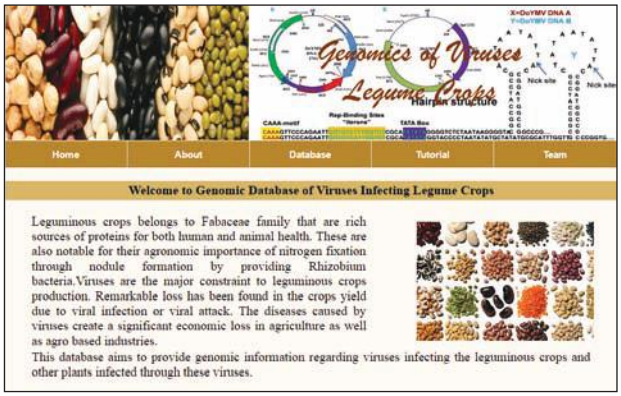


Glycemic profile of *L. rohita*, *L. bata*, *L. fimbriatus* and *Catla catla*

Genomic Data Analysis for Identification of Economically Important Markers and Viral Diagnostics in Pulses

In order to achieve the objective of viral diagnostics of legume crop, extensive literature survey was made. It's reported that 16 legume crops are infected by 86 viruses. Public domain database were used to

Search by "Plants"



Search by "Virus"

mine viral sequence. A total of 2574 viral sequence of legume crop has been mined having 1835 partial, 737 full genome and 2 genomic RNA to create database of legume virus. It was found that among 2574 genes, 515 genes are reported from India and rest 2059 from other countries.

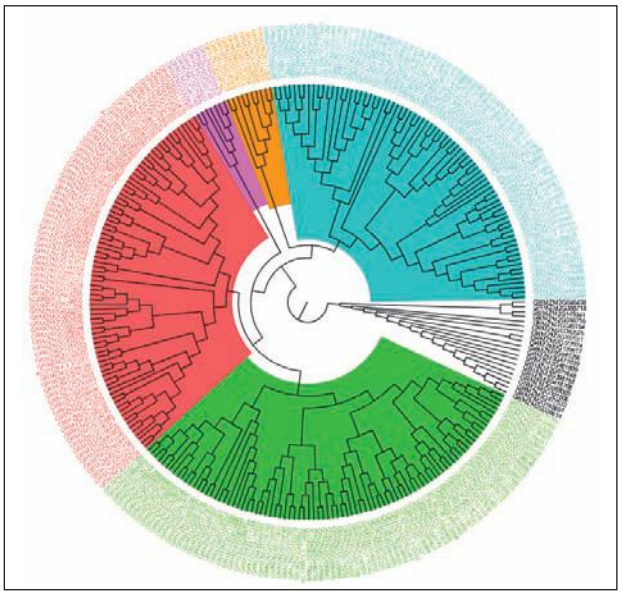
Mining and Validation of Candidate Gene Markers and Screening on Antimicrobial Peptides of Black Pepper and Small Cardamom

In order to mine SNP in black pepper, five important diverse genotypes ddRAD data were analyzed. Assembly statistics was obtained using various tools such as CLC Genomics, MIRA, RAY and Velvet assembler. Finally, 17828824 and 22474206 contigs form CLC genomics and Velvet respectively were used for SNP discovery using Samtools pipeline. Total number of 26242 and 30885 SNPs were mined using contigs from CLC genomics and Velvet respectively. Further, filters are being applied to narrow down number of SNPs to be used as potential markers. The SNPs were filtered based on depth and quality parameters. Also, the criteria of distance between 2 SNPs to be 100bp as well as 50 bp flankings on either side of a single SNP were considered. To get common SNP loci across varieties, finally 68 SNP were selected. These common SNPs were retained for further analysis. The number of transitions were 46 (67.64%), with A<>G type transitions 20 (29.41%)

in number and C<>T type 26 (38.23%) in number. The number of transversions were 22 (32.35%) with A<>T type transversions 7 (10.29%), A<>C 7 (10.29%), C<>G 4 (5.88%) and G<>T 4 (5.88%) in number. The transition to transversions ratio was found to be 4.18. For investigating geographical relatedness vs. genetic relatedness which might affect varietal signature, we used STACK pipeline. For further variety assignment, major allele frequency (0.5 to 0.929 with a mean of 0.8254), minor allele frequency (0.071 to 0.5 with a mean of 0.1745), observed heterozygosity (0.0441 to 0.1912 with a mean of 0.1112), expected heterozygosity (0.0221 to 0.0956 with a mean of 0.0556), observed homozygosity (0.8088 to 0.9559 with a mean of 0.8887) and expected homozygosity (0.9044 to 0.9779 with a mean of 0.9443) were computed. Another 24 accessions ddRAD sequence data each of black pepper and cardamom has been generated. SNPs database development has been initiated.

Studying Drought-Responsive Genes in Subtropical Maize Germplasm and their Utility in Development of Tolerant Maize Hybrid

The objectives of the study are (i) development of subtropical maize germplasm-based sequence resources for drought-responsive genes and transcription factors which are otherwise not available in the public domain (ii) to identify functional variations, alleles, evolutionary pattern of drought-responsive genes and proteins of the subtropical maize germplasm through in-silico approaches (iii) to understand gene-gene, protein-protein and gene-protein interactions as well as their cumulative effects contributing to drought stress tolerance in maize (iv) Functional validation and development of drought tolerant maize hybrids (Second Phase). Initially, a total of fifteen drought-responsive genes and transcription factor (TF) families have been selected. The sequences of all the selected genes across TFs have been collected from public domain. The exon-intron structure, sequence arrangement, protein motifs have been studied for the considered genes. The phylogenetic relationship of TF families was further studied. Also, generated the co-expression network of the drought-responsive TFs and studied the co-expression pattern in them.



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

The main objective of the study are to (i) identify and characterize SNPs associated with quantitative trait loci that control economically important traits in goats (ii) develop sequence resource on SNPs related to economically important traits using bioinformatic tools. Phenotypic data pertaining to the growth and reproduction traits was collected from Indian goat breeds across country. Besides, the genomic DNA was isolated and primers for candidate genes (ADFP, Leptin, IGF1, PrRP, TSHB, INHA, GNRH & POUF1genes) targeting growth and reproduction traits were designed.

Development of Database Repertoire for *Clostridium Perfringens* Strains Prevalent in Causing Enterotoxaemia in Goats

The main objective of the study are to (i) identify and characterise various subtypes and toxinotypes of *Clostridium perfringens* responsible for causing enterotoxaemia in goats (ii) create database repertoire for goat specific *C. perfringens* using bioinformatics tools. Field isolates from outbreak of enterotoxemia have been collected from different states including Uttar Pradesh, Haryana, Madhya Pradesh and Rajasthan. From 98 animals (86 goats & 12 sheep) and so far 29 different isolates have been toxinotyped by PCR and biochemical tests. System biology work has to be undertaken to study the molecular pathogenesis of enterotoxemia in goats.

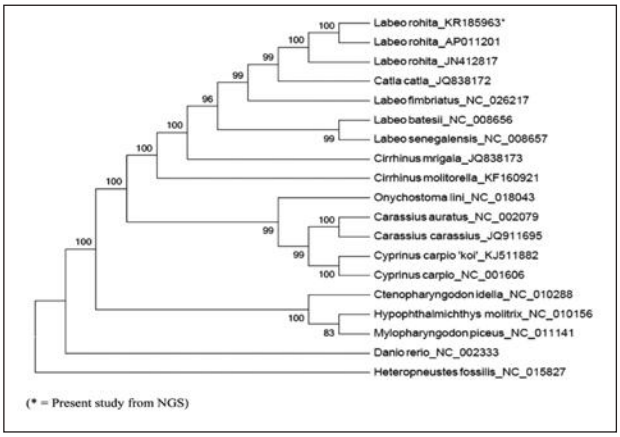
Metagenomic Applications and Transcriptome Profiling for Inland Aquatic Environmental Health Surveillance

The main objective of the study are (i) to study the microbial metagenomics collected from the polluted sites to estimate microbial communities and their imperative functions (ii) Transcriptome profiling of fish and shellfish collected from the polluted sites

to study the differential pollution stress responsive gene expressions. A survey has been conducted in the river stretches of Ganga at Bithoor, Azad Nagar, Jajmau and Jana Village near Kanpur (Uttar Pradesh) for selecting the polluted sites and for collecting the soil / sediment and water samples for metagenomic studies at these sites. The water quality parameters and other related environmental parameters were recorded from the three sampling sites near Kanpur. Survey has also been conducted in the river stretches of Ganga at Bantala, Taratala and Tangra near Kolkata (West Bengal) for selecting the polluted sites while the river stretches of Ganga at Farakka (West Bengal) have been chosen for selecting the non-polluted sites for sample collection. The gDNA has been isolated from the three environmental soil samples collected from the polluted stretch of the river Ganga near Kanpur and the metagenomes were sequenced.

Whole Genome Sequencing and Development of Allied Genomics Resources in Two Commercially Important Fish-Labeo Rohita and Clarias Batrachus

In silico approach to resolve complete mitochondrial genome assembly of rohu fish was completed. To achieve this, low-depth shotgun sequence data of Roche 454 GS FLX was used. *De novo* assembly was done in CLC Genomics Workbench version 7.0.4 and complete mitochondrial genome assembly of 16606bp was obtained which is submitted and published in GenBank NCBI with accession No. KR185963. Further analysis of mitochondrial genome revealed that it comprises of 13 protein-coding genes, 22 tRNAs, 2 rRNAs and 1 putative control region. Comparative analysis was done with other available mitogenome of vertebrates and phylogenetic tree was obtained using maximum-likelihood (ML) tree method.



ML tree of complete mitochondrial genome sequences of 19 teleosts

Rohu genome assembly:

For whole genome sequencing of Rohu fish, data generated using three chemistry *viz*. Roche 454 GS FLX (4.45 GB, 8 runs), IonTorrent (0.83 GB, single run) and Illumina (Miseq 67.98 GB and Nextseq: 142.5 GB). Final data was 215.76 GB with 143x coverage. Kmergenie software was used to predict Kmer value, which was found to be 119. Using CLC Genomics workbench software, we have completed *de novo* assembly.

In order to achieve objective of genomic resources/ marker discovery, a total of 512916 SSRs were mined from draft assembled genome using MIcroSAtellite (MISA) tool and database was also created. The motif type, number and percentage are tabulated below:

Magur genome assembly:

Whole genome sequencing of Magur fish, data were generated using three chemistry *viz*. Roche 454 GS FLX (2.47 GB, 4 runs), IonTorrent (0.64 GB, single run) and Illumina (Miseq and Hiseq: 453.88 GB). This made the final data in tune of 456.99 GB. *Kmergenie* software was used to predict *Kmer* value, which was found 121. Using CLC Genomics workbench software, we have completed *de novo* assembly.

In order to achieve objective of genomic resources/ marker discovery, a total of 702739 SSRs were mined from draft assembled genome using MIcroSAtellite (MISA) tool and database was also created.

Whole Genome based SNP Mining and Development of Breed Signatures for Dairy and Dual-Purpose Indigenous Cattle

SNP mining from indigenous cattle breed was done during the period reported upon, 777K HD chip data of 72 samples distributed over four cattle breeds (Tharparkar, Sahiwal, Vaichur, Gir) were received from NBAGR, Karnal. Data retrieval from raw file was done with standard parameters using Genome Studio software. Decoding of sample IDs were done to make the breed wise cattle data. Data size: 777962x1304. For diversity analysis and breed signature, the bulk SNP data which were in alphabetical format were converted into numerical format using PERL scripts to run various tools. In order to obtain within-breed and between-breed diversity, population genetics tool, STRUCTURE 2.3.4 and PLINK 1.9 tools were used. Chromosome wise tabulation of 777962 SNPs was done in order to develop SNP database of indigenous cattle breed. Different parameters namely, missing genotypes, Mendel errors, observed

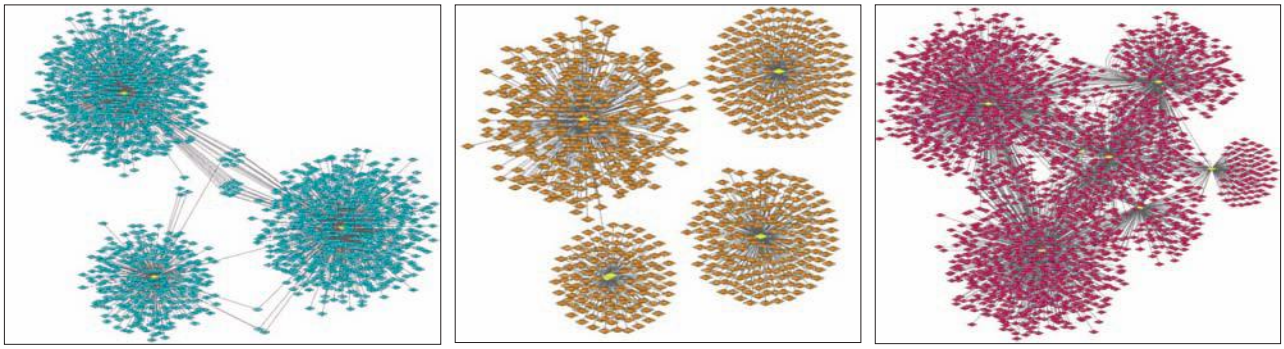
and expected homozygosity/ heterozygosity, Hardy-Weinberg equilibrium, allele Frequency, of within breed diversity analysis were computed.

Elucidating the Mechanism of Pashmina Fibre Development: An OMICS Approach

The main objectives are (i) phenomic characterization of the pashmina goats for fibre related traits under cold arid desert and temperate environments (ii) generate the proteomic map of Pashmina fibre and of follicles to understand growth phases of the fibre development (iii) identify the markers for the yield and quality traits of fibre by comparative proteome profiling under varying climatic conditions (iv) generate the transcriptome map of Pashmina hair follicles to decipher the genetic control of fibre growth (v) Comparative analysis of the transcriptomic data for identification of Pashmina fibre specific marker genes. In order to achieve the objectives, initially, Changthang region of Ladakh has been surveyed and an experimental flock of 30 pashmina goats has been established at Leh. Phenotyping of the goats for fiber characteristics has been done. Tissue sampling of skin and primary follicles for RNA isolation and keratin protein lysate has also been done. Interactive web-based software for high throughput RNA-Seq data analysis is under development.

Modeling Network of Gene Response to Abiotic Stress In Rice (NFBSFARA) Hormone Regulatory Relationship between TF's and their Target under Combined Salt, Drought and Heat Stress

Phytohormones are pivotal substance for proper plant growth and development. Hormonal regulation of abiotic stress involves a complex interplay of signalling molecules. Understanding hormone regulatory complex interaction among the avalanche of bio-regulators present within plant cell may provide the genetic tools to maintain potential crop yield under stress. Thus, the present study is focused on a systems biology approach to develop Hormone Gene Regulatory Network (HGRN) signalling involving Transcription Factor's (TF) targets under salt, drought and heat stress. Hormone induced differentially expressed genes and TFs, specifically under ABA, GA and Auxin stress, were filtered out from 196 microarray data sets. A large scale hormones based GRN analysis was performed through ARACNe, CLR and RN by integrating the data with previously generated miRNA's linked to abiotic stress. A combined stringent cut off error tolerance $\varepsilon = 0.2$ and a *p*-value threshold of mutual information (MI) at 0.05 were used in inference of global gene networks. Based on the consensus of 100 bootstrapped networks, it was observed that 14 TFs genes resulted in 296 downstream targets (Figure). Topology analysis of the networks reveals that the networks are a scale free network and majority of the target genes are regulated by relatively small number of regulators. These small number of regulators are regarded as hubs of the regulatory network and may play crucial role in coordination of expression of genes among the hormones. Further, the identified target genes were annotated and *in-silico* validated by using AgroGO, GeneOscilloscope of Plexdb, MEME and TOMTOM. The present study provides an insight into hidden crosstalk's the influence of three hormones i.e. ABA, GA and Auxin, under combined drought and salt stress with within plant. It was observed that this hormone governing network have particular topological properties in transcriptional regulatory networks and relates to certain regulatory mechanisms in gene regulation.

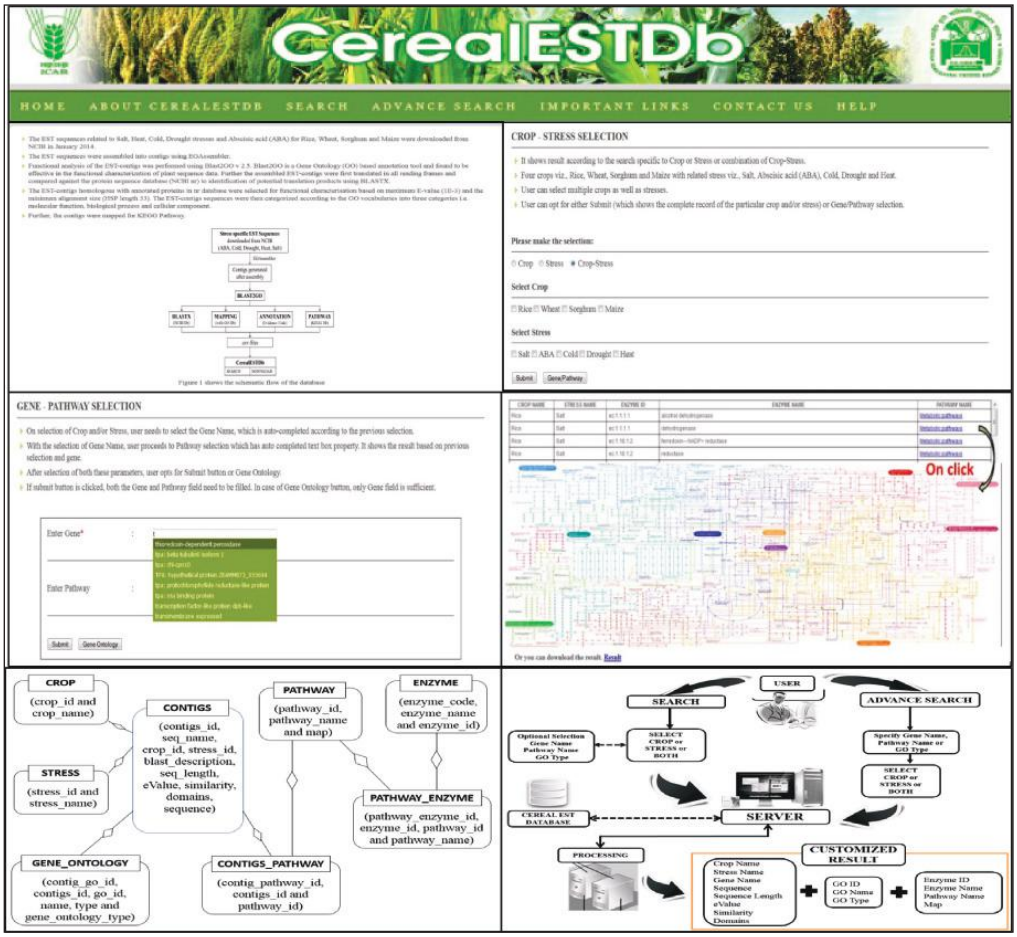


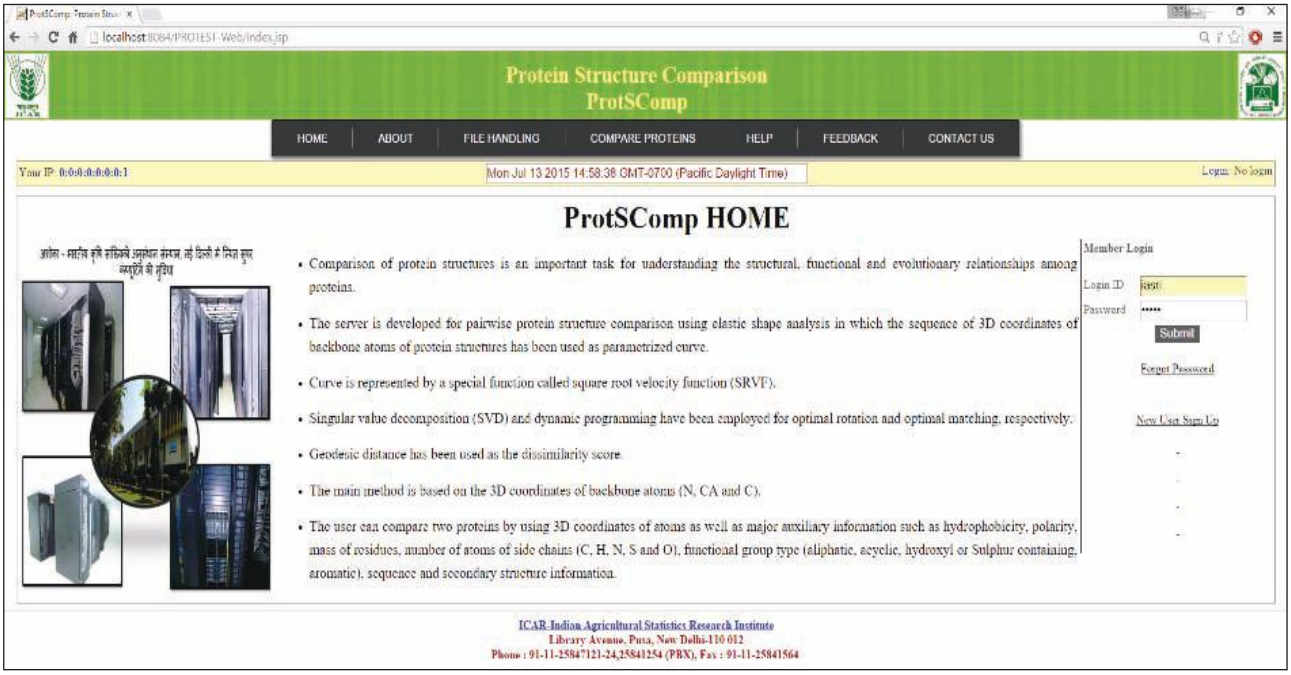
i) GA Regulated TF's – Targets network ii) Aux Regulated TF's – Targets network iii) ABA Regulated TF's – Targets network

Gene Regulatory Networks for the hormones ABA, GA and Auxin induceTF's and their identified target genes

CerealESTDb: A Searchable Database for Abiotic Stress Induced, Annotated Ests of Cereals

Cereals are quite sensitive to different abiotic stresses, which causes drastic reduction in their productivity and quality. These abiotic stresses are prevalent, especially in the changing climatic conditions. In view of this, lot of data has been generated in recent times on the stress induced transcripts such as Expressed Sequenced Tag (ESTs), microarray, RNAseq etc. Among these data, abundant amount of ESTs related to abiotic stress in various cereal crops are available. However, the data on stress induced ESTs of the cereals remains largely underutilized as they are scattered. Therefore, a user-friendly, searchable, interactive and web-based database named as CerealESTDb has been created. This database contains assembled and annotated ESTs of rice, wheat, sorghum and maize induced under Cold, heat, drought, salinity stress as well as on application of ABA. This will also provide information about genes, ontology and corresponding pathways related to these ESTs. Some of the genes reported here are putative and novel in nature. This database is intended to present details of biological process at molecular level responsible for abiotic stress mitigation/process. The CerealESTDb contains unique entries with respect to genes, pathways and gene ontology terms and can be accessed at http://cabgrid.res.in/CerealESTDb.



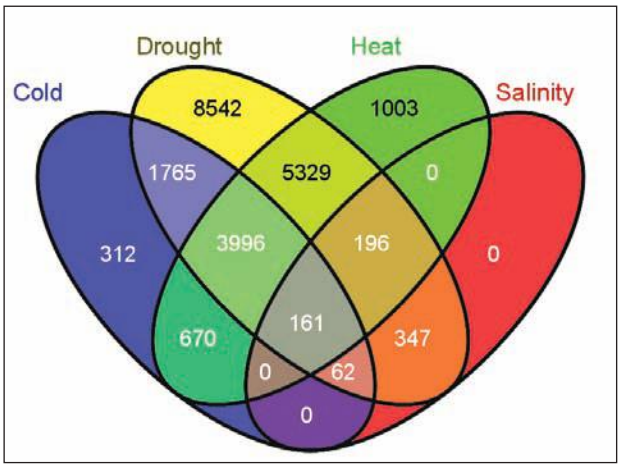


Methodology for Protein Structure Comparison and its Web Implementation

Protein structure comparison plays an important role in *in-Silico* functional prediction of novel proteins. It is also used for understanding the evolutionary relationships among proteins and predicting protein structures and their related functions. This will further help in understanding related coding genes and their use in development of superior varieties/breeds / commodities in agriculture. In order to develop algorithm and tool for protein structure comparison, an efficient technique has been developed for comparing protein structure using Elastic Shape Analysis (ESA) in which the sequence of 3D coordinates atoms of protein structures has been used as parameterised curve which is supplemented by addition of auxiliary information based on side-chain properties. The performance of the developed algorithm/tool is tested and found to be more efficient than the existing methods. Also, user friendly web-based application called ProtSComp has been developed using above algorithm that can be accessed freely by the users.

Multilabel Functional Classification of Abiotic Stress Related Proteins in Poaceae

SVM, RF and ANN models were developed for multilabel classification of proteins into different abiotic plant stresses i.e. heat, salt, cold and drought stress. A web tool for predicting involvement of the proteins in heat, salt, cold and drought stress was constructed.



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

The alignment of protein structures and pair wise comparison is a difficult task in structural biology. The major approaches to structure comparisons are rigid body alignment and fragment based alignment. In this study, we have considered fragment based alignment. This requires three strategies namely alignments of Cα, and Secondary Structure Elements (SSEs), intramolecular and inter-residue distances (SSAP, DALI) based comparisons, matching main-chain fragments by CE using Combinatorial Extension & dynamic programming. The set of Cα distances for octamers (i.e., between eight consecutive residues in the structure) and each pair of octameric fragments that can be aligned within a given threshold is considered an Aligned Fragment

Pair (AFP). Secondary Structure Elements methods (VAST, SARF, MATRAS and FATCAT) use the Cα atoms to generate a set of vectors of connecting residues. Such vectors effectively represent the structure in two dimensions providing both positions and directions. However, these methods are suffering from many disadvantages such as ignorance of coiled regions that are active sites, decomposition of protein structures to smaller blocks, scoring function in rigid-body superposition, and allow "hinges/ center" between super possible rigid parts. Most of these methods are based on only Cα by ignoring side chain and other atoms. Based on literature survey, graph theoretic approach is being used for quantifying 3D protein structure and pair wise comparison to address these limitations. Generally graph theory is used to represent/decipher complex spatial structure which are mutually connected and dependent. Since, 3D structure of protein is complex structure, hence the graph theory based approach can be utilized to compare the protein 3-D structures. The proposed algorithm has been implemented in MATLAB. MATLAB programs have been written for Reading PDB files, selecting model and chain in the given PDB files, Building graph adjutancy and distance matrix, partitioning of the graph using spectral & MCL clustering techniques, building binary 2D structure matrix and superimposing the matrices. Preliminary analysis and results are obtained for some sample proteins using proposed method and compared with existing FATCAT and CE methods.

Development of 16s rDNA Rumen Microbes Specific Database

The rumen is a complex natural ecosystem containing number of bacterial, fungal, protozoal and archaeal species which is a biological network to break down plant material. Ruminant animals obtain most of their nutrients from fermentation of plant products produced by rumen microbes such as bacteria, archaea, protozoa and fungi. Bacteria, along with protozoa, form the predominant microbes accounting for 40-60%, fungi accounts for 5-10 percentage of total microbial matter in the rumen and Rumen Archaea, approximately forms 3% of total microbes. Bacteria play a very important role in rumen digestion. In rumen, 80% contribution for degradable of plant cell walls is by a combination of bacteria and fungi and remaining is by protozoa. There microbes have both negative and positive effect on fiber digesting in ruminant environment. Studies on these microbes will provide further insights into various diets and integration with nutrients. Although, many studies have been published that characterize the ruminal microbes using cultivation-based methods. 16S rRNA gene sequences were applied to investigation of the diversity of ruminal bacteria and archaea. 16S rRNA gene sequences information have been used as the "gold standard" for identification and taxonomic classification of bacterial species. Analysis and comparison of the bacterial 16S rRNA sequence is a valuable genetic technique and can lead to the recognition of novel pathogens species. 16s rRNA sequence data is available in diversified format and in various public databases. The 16s rRNA data is a quite large and dynamic data, there is need to develop rumen specific microbes 16s rRNA database for wide comparative and analysis of microbes within and between species.

The main objectives of the project is to collect data from public domain, standardise the data, develop DMBS and BLAST database and web tools to search microbes in the databases and phylogenetic analysis. So, to achieve the objectives, we have collected 2,09, 177 RNA data from public databases and published literature. Then pre-processed the data and selected only 10539 data for development of rumen specific microbes' database. Phylogenetic tree has been generated with selected microbes sequence data. Developed a database on Relational DataBase Management System (RDBMS) concept for searching microbes by keywords and BLAST database has been created to search microbes by sequence. BLAST database has been created and placed at the shared folder in the ASHOKA cluster.

Database Design and Development

The database with appropriate data structure and standardized data tables to facilitate integration using the relational data model. All these tables are created in relational database management system (RDBMS) in MYSQL. The database developed as per entity relationship diagram shown in Figure 1.

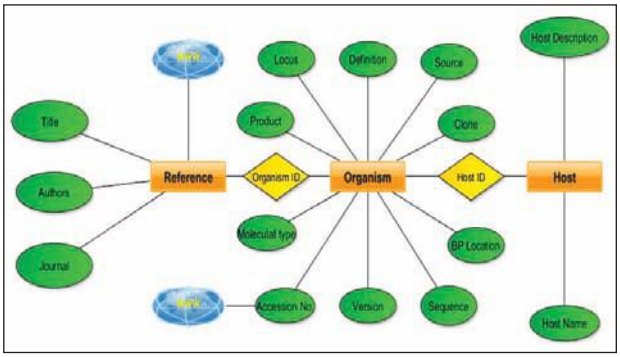


Fig.1: To Develop Web Tools for Searching and Analysis Sequences/Microbes

Web tools have been developed using PHP as server side scripting language, HTML and Java as client side scripting language and MYSQL as back-end database for storing and management of data.

Introduction Page

This page (Figure-2) briefed regarding problem definition at national level and, features and benefits of the rumen 16s rRNA database and web portal.

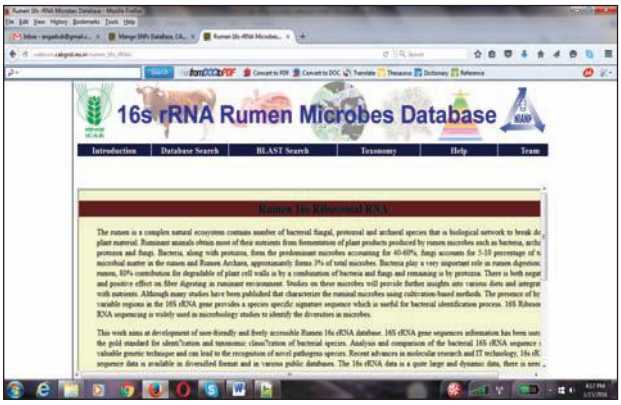


Fig. 2: Introduction Page

BLAST Database Search Input Page

Provision has been made to user to provide RNA sequence as plain text or upload a RNA sequence file as input to search in the BLAST database (Figure-3). Sample sequence button also provided for simple testing by user. PHP codes have been written to search a given input sequence in the BLAST database using MPI BLAST search tool enabled to use multiple nodes in ASHOKA by means of SSH connectivity to cluster. The final result file will be moved from cluster to web server user temporary directory.

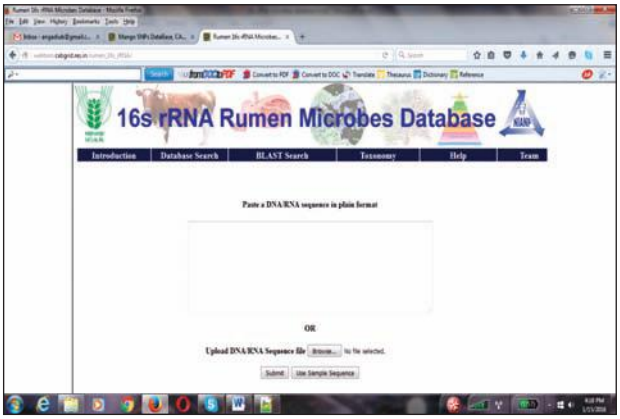


Fig. 3: Sequence Input Screen

BLAST Database Search Output Page

This page (Figure-4) provides result after searching a given sequence in BLAST database, which was stored in the user temporary directory.

Fig. 4: BLAST Result Output Page

PHP codes have been developed to integrated best hit microbe in the phylogram and presenting the phylogenetic tree using SVG format (Figure-5).

Fig. 5: Phylogenetic Tree Page with Highlights of Nearest Microbes to the Given Query Sequence

Network Project on Transgenic in Crops

In order to resolve mango genome assembly issues due to highly heterozygous genome of Amarpali, PacBio based NGS data with longer read lengths of >3.5 kb using P4C2 and P5C3 chemistries with 70Xgenome coverage were generated. *De novo* sequence assembly using FALCON PacBio diploid genome assembler resulted in an assembly of 323 Mbp, covering 73.2% of the of mango genome in just 9,550 large contigs, with largest contig size of 1.09 Mb and a high N50 value of 98.3 Kb. *In silico* gene prediction using FGENESH programme of MOLQUEST software (www.softberry. com) revealed total 43,247 gene models with average gene size of 894 bps and a range of gene size from 150 to 12,102 bp. Standalone BLASTx programme was used for the annotation of all predicted gene and observed 33,365 (77.14%) genes annotated while 9,882(22.86%) genes, which did not show any match with NCBI-NR database were reported as novel mango genes.

Computational approach to syntenic studies revealed that two different species of *Citrus* (*C. sinensis, C. clementina)* were having 9,139

and 6,257 homologous genes. Annotated gene sequences were further classified into various functional categories like physiological, DNA synthesis, disease resistance, defense response, protein synthesis, stress response, TE related and hypothetical protein.

World's first Mango Genome Draft assembly of this multi-institutional project was selected for oral presentation in largest agri-genomic conference of the world (Abstract No. W315) https://pag.confex.com/pag/xxiv/webprogram/Paper21622.html

Programme 5: DEVELOPMENT OF INFORMATICS IN AGRICULTURAL RESEARCH

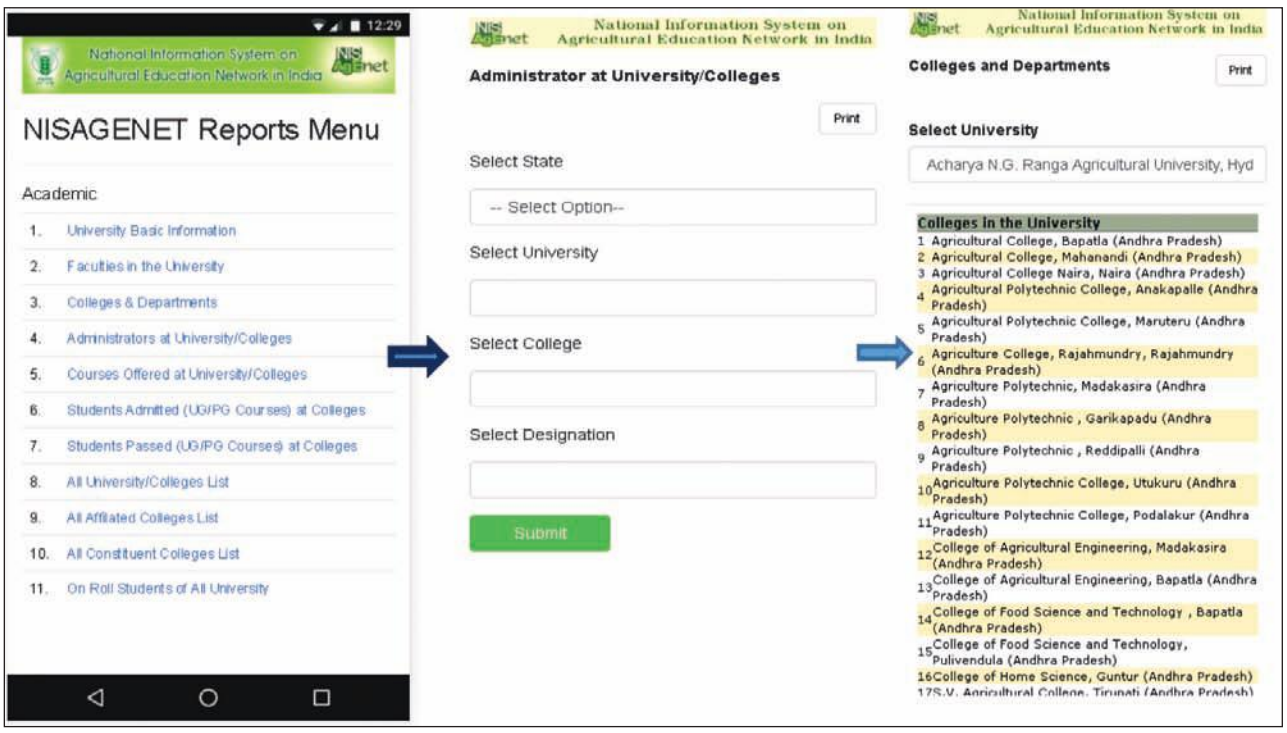
National Information System on Agricultural Education Network (NISAGENET)

The NISAGENET is being maintained as a single Window Information Delivery System and is an effective solution to check overlapping and parallel flow of information, i.e. information flow from the same university but from different sources has been avoided.NISAGENET has been maintained as a regular ongoing activity of the council at IASRI, New Delhi. It is mandatory for all the agricultural universities to actively participate and provide the data as per requirements of this system. As NISAGENET system is successfully running for last 12 years, it has been observed that the existing data collection schedules need to be streamlined so that the data quality can be improved and gaps can be minimized. As per the feedback from ADG(EPHS) and Nodal officers of the universities, the existing schedules were modified and the corresponding changes are made in the online system. Efforts have been made for updating of student on roll data. 53 universities have uploaded the data. Faculty profile module is taken up with more numbers of universities and more than 1200 faculty profiles have been made online till date. All NISAGENET reports have been made accessible to Google Chrome as well as Mozilla Firefox Browsers. A mobile app for accessing NISAGENET reports has been developed and is made accessible from NISAGENET website.

Management System for Post Graduate Education-II

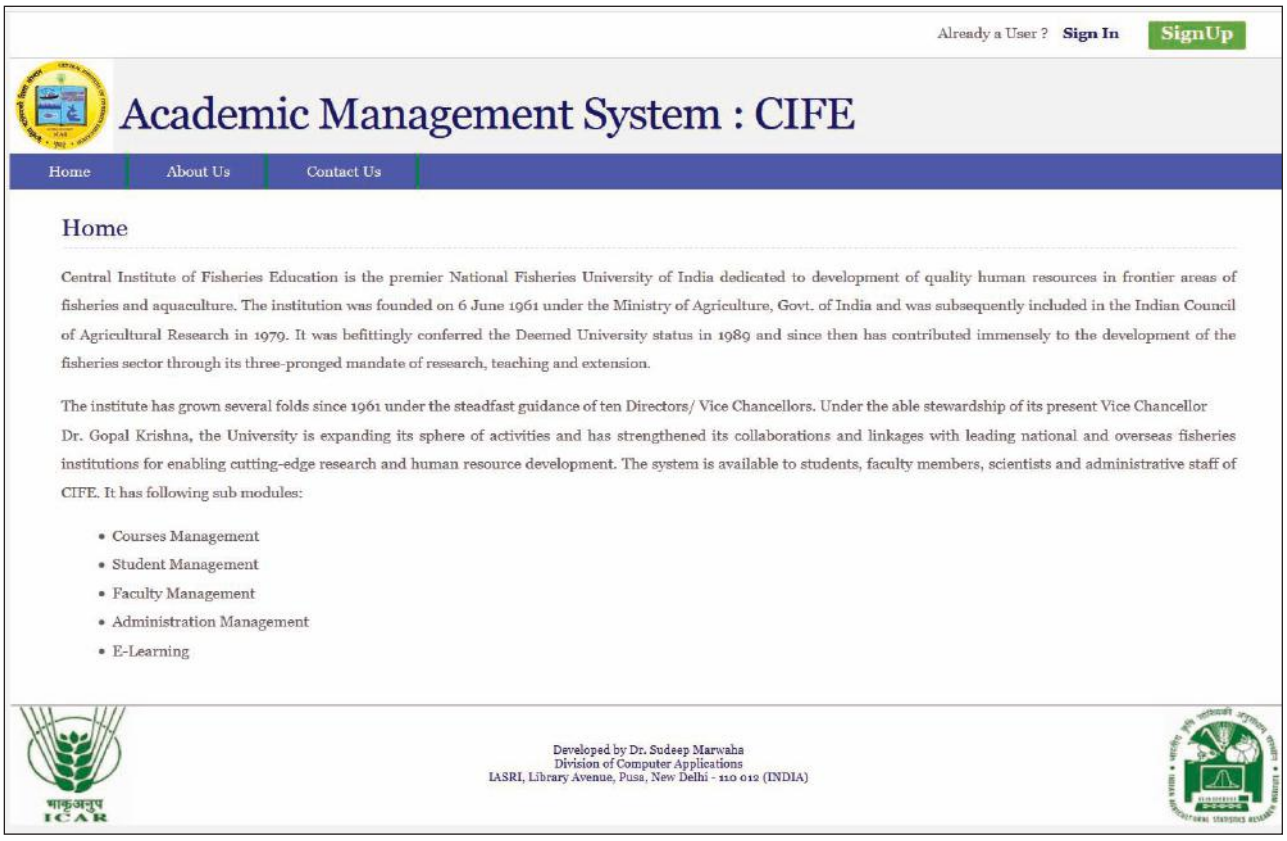
Seminar search report has been developed for checking the seminar topics at the student and guide level. Multiple reports have been refined. These include Faculty Course Report, Faculty Student Report, Course Schedule Report etc. Multi-Campus functionality has been strengthened to include more reports and e-learning functionality. CIAE Bhopal campus has been made online and now the students and faculty from the CIAE can interact with the system for their assigned work.

Work for converting the whole system from fix role to dynamic role based system is in progress. For taking attendance of students, designing of a mobile app. is initiated.



New students for M.Sc. and Ph.D. for IARI New Delhi, IIHR Bengalore, CIFE Bhopal, IARI Assam, IARI Jharkhand has been registered in the system. Support has been provided to solve the queries of the various users. Regular backup of developed web-pages and database of the project was taken.

Academic Management System CIFE (AMS-CIFE) is a web enabled system for management of various academic activities of the University. It is the second system launched in line with Management System: PG School IARI. Both these systems are based on the Management System for Post Graduate Education (MS-PGE) which is used as the base technology for these systems. The system caters to the requirements of different users: Dean, Registrar, Heads, Guides, Faculty, Teachers, Students, Administrators and Officials for performing their assigned tasks. All the faculty members and students of CIFE were registered in the system. Various courses offered by CIFE were also entered along with the credit details as well as faculty allocated to the respective courses. Students also filled the Roaster Form online for 2nd semester registration and respective Course Leaders and Guides approved the registered courses online. Faculty has also started uploading the detailed course schedule of their respective courses online. The system once completely implemented will enhance the overall efficiency of the academic system. At the same time it will facilitate e-learning for the students. The system was made accessible online at http://amscife.icar.gov.in_from ICAR Data Center at IASRI.



AMS-CIFE Homepage

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

A web based results framework document management system has been developed to manage RFD activities in ICAR. The system facilitates institutes to prepare, submit targets and achievements online and provide access to officials authorized by the Institutes, respective SMDs and RFD coordination unit in ICAR. It facilitates generation of consolidated reports. It simplifies the process of RFD preparation, information flow and generation of reports for effective management and monitoring.

The system has been designed and developed in 3-tier architecture on the .NET platform. The user interface has been developed using HTML CSS, JSP, the application layer has been developed using ASP.net and the database layer has been designed using

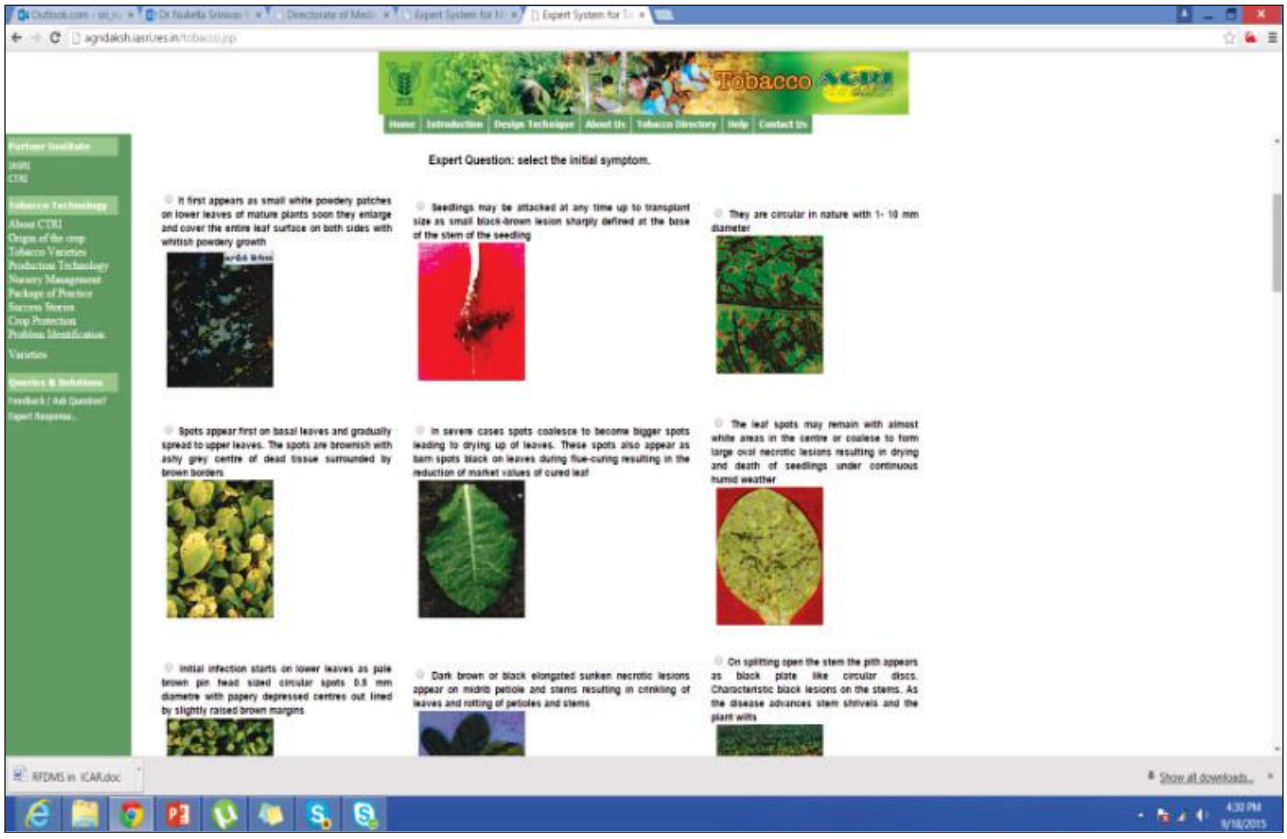
MySQL. The system has a user interface for online data entry, updation and modification of all sections of RFD document. The system has been divided into two components such as user and administrator. The user module has the access to the system for online data entry, updation and modifications of all the sections of RFD document from time to time. The administrator module of this system has the control to create a new member of this RFDMS, manage the database, delete unwanted information and modify the existing database etc.

The home page interface consists of member login and password fields which allow the organization to access RFD management system. After entering the login details, the user can access the system. The system has been divided into three main modules viz., 'Prepare RFD', 'Input Achievements' and 'Print RFD'. The 'Prepare RFD' module allows the organization to prepare their result framework document, the 'Input Achievements' module allows the organization to enter the achievements and the 'Print RFD' module allows to prepare various reports and provide print option.

Tobacco Agridaksh : An Online Expert System

Tobacco production and quality are widely affected by fungal, viral and nematode diseases in both nursery andfield crop. The yield losses ranging between 21-53% from various diseases have been documented. Important diseases affecting the tobacco are Frogeye spot, Brown spot, Black shank, Damping-off, Wilt, Root-knot, Mosaic and Leaf curl diseases. The identification of diseases is the difficult task and often requires consultation with specialists. An accurate and rapid diagnosis can avoid losses by taking appropriate management practices. Scientists have developed various management practices for many diseases of tobacco, detailed digital photographs of symptoms are made available and precautionary measures are established.

Based on this data, an online knowledge base system for disease identification in tobacco has been developed using Agridaksh tool by ICAR-IASRI in collaboration with ICAR-CTRI to provide global accessing of all information on various diseases of tobacco and their symptoms. Under this system, a knowledge model has been created, a knowledge acquisition, ontology based problem identification and a knowledge retrieval system for tobacco disease has been developed. This system is useful to enhance the efficiency of farmers, agricultural extension personnel, development agencies for crop management and to increase the crop yield. It determines the best strategy for disease management, identification and diagnosis.



(Various symptoms of tobacco diseases)

Cluster Ensemble Algorithms for Germplasm Evaluation of Chickpea

Review of literature of cluster ensemble techniques and germplasm evaluation has been carried out. Meetings and discussions with associates at NBPGR, New Delhi have been conducted. The cluster ensemble algorithm has been modified and tested with multi character data sets of Chickpea. . The result shows that this method improves the clustering as compared to other traditional clustering algorithm.

Developing a Comprehensive Web Based System for Agriculturally Important Microbes

Concerned scientists have visited NBAIM, Mau to discuss the implementation plan and requirement analysis of the project and collected some materials on Microbes. Home page and Interface for the framework is being designed. Information on microorganism collected has been organized. Fields for designing data base has been identified. Database designing has been with the available information.

Knowledge Management System for Agriculture Extension Services in Indian NARES:

The meetings were held to study the ongoing schemes/projects, existing databases, software's, study the requirements related to extension activities such as various services being provided by ATARI, KVKs, databases on technologies/ varieties, reporting process, monitoring process etc. The existing databases have been studied and workflow between KVKs, ATARIs and SMD, and the requirement analysis has been done.

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

Implementation of ICAR-ERP solution was completed in all 109 Institutes (ICAR Headquarter, ASRB, Institutes-99, and ZPDs-8) and Knowledge enhancement sessions on ICAR-ERP were organized. Besides online sessions were also organized on demand for various institutes. To facilitate the trainings, User Manuals, Short Manuals related to Process and Video Tutorials have been developed in all the functional areas. All these material is available on the project web site (http://www.iasri.res.in/misfms).

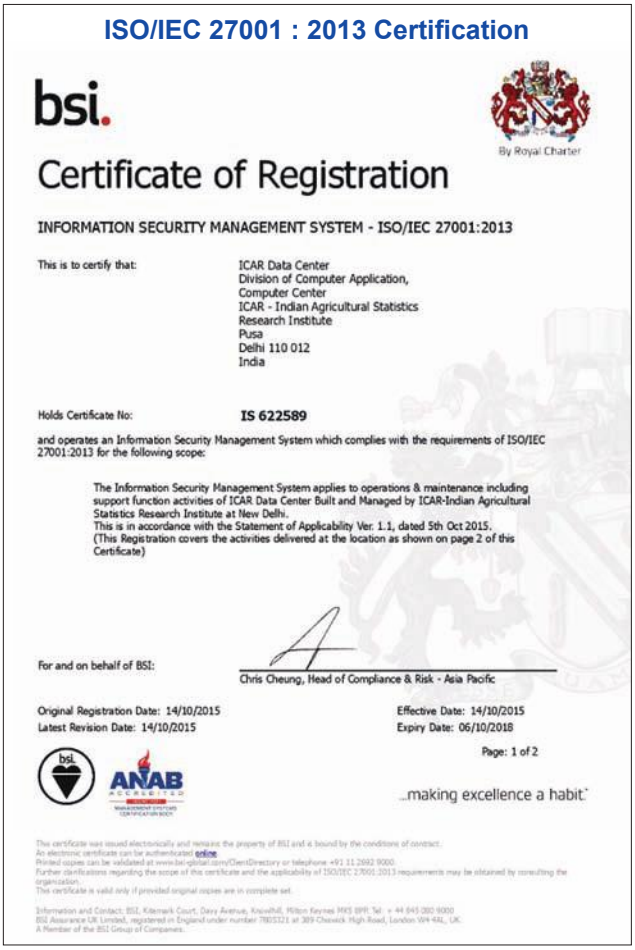
Regular backup on tape and SAN was taken. Server maintenance activities were carried out during this period. Feedback Performa was prepared and sent to all the ICAR institutions. Feedback was received from 36 institutes and report was submitted to the office of DG (ICAR). Major functionality enhancements and need based reports were done for the Payroll and HR modules along with reports refinement in the Finance module. Support for the ICAR-ERP solution is provided from central help desk at IASRI by IBM through phone call and email. Need based, additional support from Project Team of IASRI is also provided to institute through Video-conferencing and Unified Communication using Lync. Data Center has been made operational under component ICT Infrastructure and Unified Messaging & Web Hosting Solution for ICAR. Data center provides 24*7 environments for running the IT services. Unified messaging solution (email with chat features) has been implemented. At present about 14000 Email ids have been created for ICAR officials, all Directors and ICAR institute personnel with "icar.gov.in" domain and About 10,000 lync user have been created. ICAR Data Centre established at IASRI holds the certification for ISO/IEC 20000 (the standard for IT service management) and ISO 27001 (the best framework for complying with information security legislation).

Twenty three Websites /Portals have been hosted from IASRI Data Center. These portals are of eCOURCES, NISAGENET, CBP, NAIP, KRISHI, LIB, CRRI, AGROWEB, NASF, CRIJAF, JAFEXPERT Expert System, Biosafety, Ezee Proxy, CAPI, ICAR, AICRP etc. Zonal workshops were organized on Unified Communication solution at five locations. Support is being provided from central help desk at IASRI through phone call and email by WIPRO team. IASRI team is monitoring the overall data center and support services. Policy/ Process has been designed for creation of e-mail id and hosting of websites/applications.

ICAR Data Centre Operational activities details are given below. 23 Websites/Portals have been successfully hosted from ICAR-Data-Centre.

- Number of tickets resolved till July 2015 was 3464 and from August 2015 to April 2016 is 5216.
- 121 Total LUN's (Logical Unit Number) was till July 2015 and from August 2015 to April 2016 count is 136.
- Number of Tapes Utilised was 20 till July 2015 and become 33 till April 2016.
- Number of Host attached in ICAR-DC was 47 and till April, 2016 it increased till 56.

ISO/IEC 27001 : 2013 Certification



bsi.

By Royal Charter

Certificate of Registration

INFORMATION SECURITY MANAGEMENT SYSTEM - ISO/IEC 27001:2013

This is to certify that:

ICAR Data Center
Division of Computer Application,
Computer Center
ICAR - Indian Agricultural Statistics
Research Institute
Pusa
Delhi 110 012
India

Holds Certificate No: **IS 622589**

and operates an Information Security Management System which complies with the requirements of ISO/IEC 27001:2013 for the following scope:

The Information Security Management System applies to operations & maintenance including support function activities of ICAR Data Center Built and Managed by ICAR-Indian Agricultural Statistics Research Institute at New Delhi.
This is in accordance with the Statement of Applicability Ver. 1.1, dated 5th Oct 2015.
(This Registration covers the activities delivered at the location as shown on page 2 of this Certificate)

For and on behalf of BSI:

Chris Cheung, Head of Compliance & Risk - Asia Pacific

Original Registration Date: 14/10/2015
Latest Revision Date: 14/10/2015

Effective Date: 14/10/2015
Expiry Date: 06/10/2018

Page: 1 of 2

...making excellence a habit.

ISO/IEC 20000 : 2011 Certification

bsi.

By Royal Charter

Certificate of Registration

IT SERVICE MANAGEMENT SYSTEM - ISO/IEC 20000-1:2011

This is to certify that:

ICAR Data Center
Division of Computer Application,
Computer Center
ICAR - Indian Agricultural Statistics
Research Institute
Pusa
Delhi 110 012
India

Holds Certificate No: **ITMS 622590**

and operates an IT Service Management System which complies with the requirements of ISO/IEC 20000-1:2011 for the following scope:

The Information Technology Service Management System of ICAR Data Centre applies to Data Centre Operations, Maintenance & Support function activities including IP Networks, Servers, Database, Storage, Backup, Helpdesk, Non-IT Support, Unified Messaging & Web Hosting Solution to ICAR User Departments & Institutions.
This is as per the latest Service Catalogue.

For and on behalf of BSI:

Chris Cheung, Head of Compliance & Risk - Asia Pacific

Original Registration Date: 14/10/2015
Latest Revision Date: 14/10/2015

Effective Date: 14/10/2015
Expiry Date: 06/10/2018

Page: 1 of 2

...making excellence a habit.

- Over All Row capacity was 143.5 TB till July 2015 and increased successfully up to 231.717 TB in ICAR-DC.
- Used Storage Pool Capacity till July 2015 was 88.25 TB and April 2016 it become 91.27 TB.
- Number of Backup client is 46 which has not been increased since July 2015.
- Total Mail Transition were 2554107 till July 2015 and since July 2015 to April 2016 it is 3551406.
- On the base of requirement, 9 websites were hosted in ICAR-DC till July 2015 and since July 2015 to April 2016 count increased by 14 and we are hosting 23 websites successfully in ICAR-DC.
- Total Windows Servers in Cisco Chassis till July 2015 was 72, 6 New Windows servers has been added since July and now we are managing 78 Windows Servers at Cisco Chassis in ICAR-DC.
- Total Windows Servers in Dell Chassis till July 2015 was 8, 15 new Servers has been added since July and now we are managing 23 Windows Servers at dell Chassis in ICAR-DC.

Development of Software for Data Entry and undertaking, Analysis of Data for Storage Losses in FCI/CWC Godowns

Requirement Analysis for development of Data Entry software for Analysis & Monitoring of storage losses in food grains have been carried out. The software is to facilitate reporting of data collected from godowns for four commodities at the periodic level starting from storage to liquidation based on moisture parameters recorded on sample taken from the stack, weather conditions, infestation status etc. This is standalone software to be used by the identified 20 AICRP-PHT Centres and has the feature of export utility to send the updated data to AICRP-PHT Ludhiana and import utility to import the data in central database for further analysis. This has been developed in MS-Access.

Phenomics of Moisture Deficit and Low Temperature Stress Tolerance in Rice

Phenomics computation facility has been created for storing the image data, developing the models for analysis of the image data, hosting the solutions developed under the project. It consists of 1 Application Server, 1 database server and 1 storage

of 15TB size. A Multimedia Data Management System has been developed. It is a web-based resource for a community of researchers to contribute, access and share the experimental data. It allows users to store experiment data files (digital images, pdf, excel, doc file etc.) online with corresponding meta-data and share data collections with a user community. Workflow was added to the system for adding/ updating the project data. The GUI of Multimedia Data Management System has been strengthened with additional reports. A Non-destructive approach

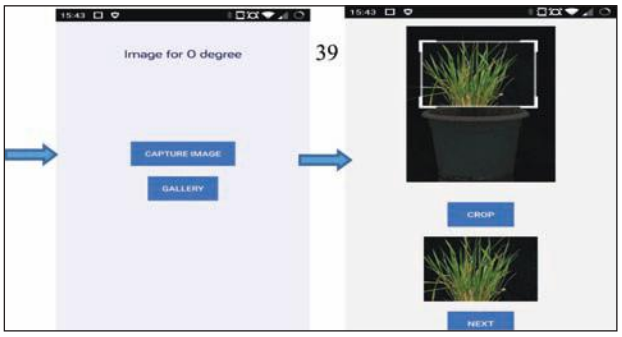
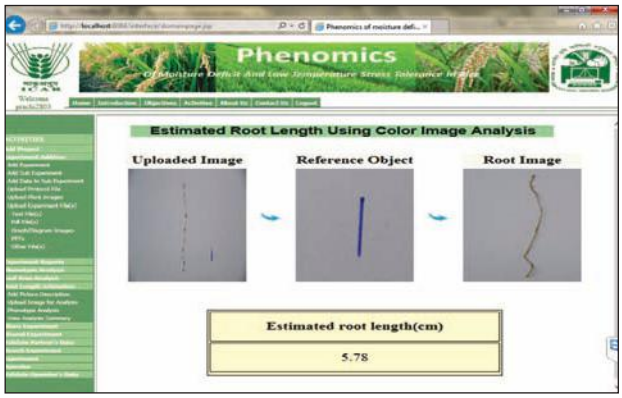


Fig.: Leaf Area Estimation through Mobile App

for Leaf Area estimation through image analysis has been developed. This helps users in finding out the leaf area of a rice plant in pot condition by uploading its photograph on the online system. A mobile app for this purpose is also developed to enable user in uploading photographs from mobile as per the instructions and estimated leaf area.

The root length module to estimate the length of a single root hair has been developed. In this module, the length of the root hair is determined by uploading the image of the roots spread on a sheet of a paper. Till now, length of a single threaded root can be calculated from this module and the same has been developed and integrated with the existing system in the development server. Many samples of roots have been collected from IARI.

An experiment consisting of 10 genotypes was conducted for estimating the leaf area and chlorophyll content in test and stress condition for Rice crop. In this experiment, water stress was given and photographs were taken daily of rice plants in pot condition for five days. Three replications were used per genotype for destructive as well as non-destructive phenotyping. Efforts have also been made to estimate the chlorophyll content using non-destructive image analysis. Support has been provided for uploading the data in the Multimedia data management system. Many partner institutes have uploaded their data in the system. Final report writing was taken up and Server side maintenance has been taken up regularly.



Development and Application of Electronic Learning and Diagnostic Modules for Health Management of Dogs

Dog Health Management Trainer (DHMT) has been developed to disseminate information on various aspects of dog health. The multimedia enabled end user interface has been categorized into four modules i.e., breed database, general information, breeding & health care and vaccination & deworming. The system provides stepwise information to end users regarding important aspects related to dog health. The system was evaluated in the IVRI Polyclinic though a survey by interviewing 100 users. The System was demonstrated to users for evaluating their perception on four parameters viz completeness, utility, user friendliness and interestingness of the system (Fig.1) and the results indicated that 81% replied that the system was 'complete'; 57% found that the system will be of 'utility" and useful; 67% answered that the system was 'user friendly' and 60% observed that the system was 'interesting'. Regarding the purchase of the system, 87% dog owners showed keen interest to procure the system. However they wanted to procure on a modest cost of less than 250/=. This is the first version of expert system for dog health. Detailed information on 48 diseases of dogs is available in the system. The user will login to the system and select the symptoms from the drop down list for different diseases and for their control and prevention (Fig 2). Based on the selected symptom, the system identifies the disease tentatively. It provides detailed information about the disease i.e. epidemiology, clinical symptoms, diagnosis, prevention and control. If the system is unable to identify a disease then system advises to consult the doctor. The modules have been evolved using latest web technologies including JSON, CSS3 and JavaScript. The database was created using IndexedDB.

Algorithm for Protein Structure Comparison

Protein structure comparison plays an important role in In-Silico functional prediction of a new protein. It is also used for understanding the evolutionary relationships among proteins, predicting protein structures and functions. In this study, an efficient methodology has been developed for comparing protein structure using Elastic Shape Analysis (ESA) in which the sequence of 3D coordinates atoms of protein structures has been used as parameterised curve which is supplemented by addition of auxiliary information based on side-chain properties. This curve is represented by a special function called Square Root Velocity Function (SRVF). Further, Singular Value Decomposition (SVD) and dynamic programming have been employed for optimal rotation and optimal matching of the proteins. Also, Geodesic distance has been calculated and used as the dissimilarity score. The performance of the developed methodology is tested and found to be more efficient when compared with the existing methods. Source codes for different functions have been developed in R. Also, user friendly web-based application called ProtSComp has been developed using above algorithm for comparing protein structures that can be accessed freely by the users.

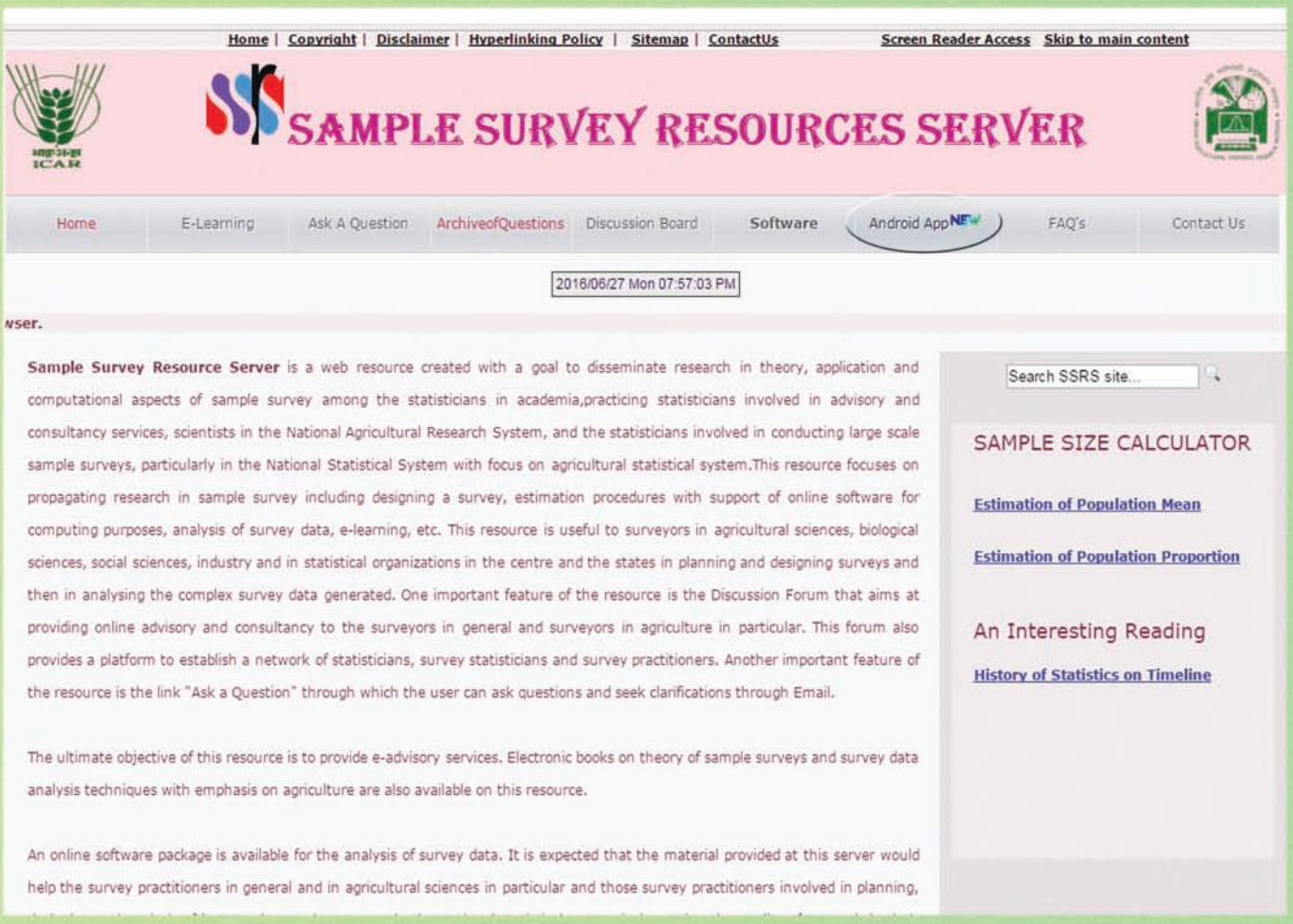
Strengthened Design Resources Server by Balanced Incomplete Latin Square Designs

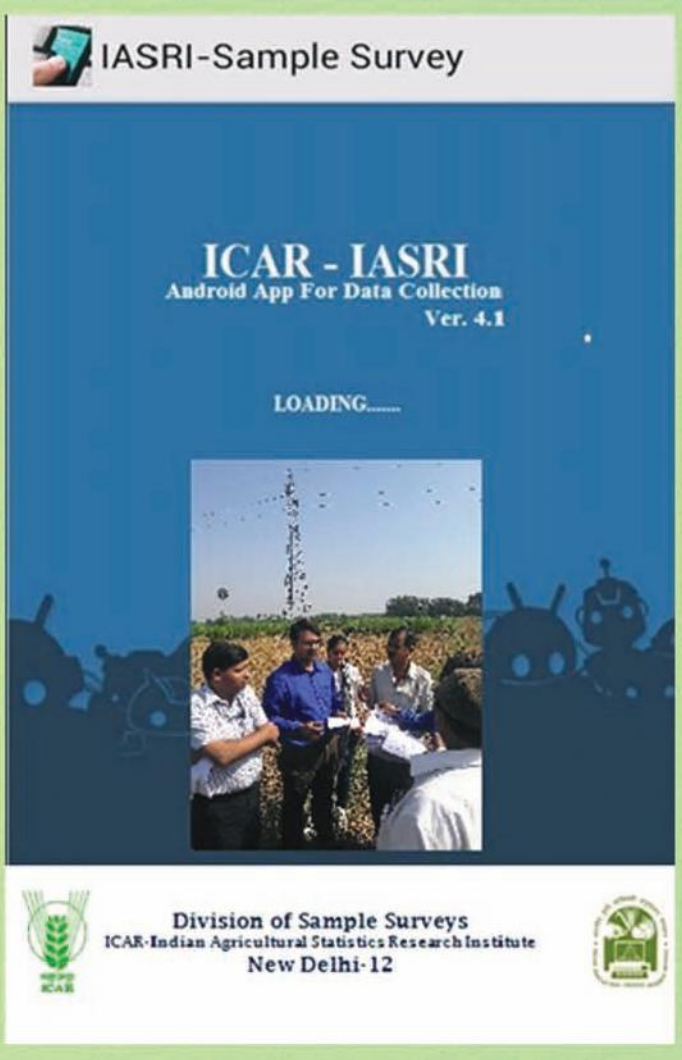
Latin square designs are widely used in comparative experiments where two crossed blocking factors are present and each blocking factor has v levels, where v is equal to the number of Latin letters in the Latin square or the number of treatments in the design. In this arrangement, each Latin letter appears in each row and each column precisely once. However, it may not always be possible to accommodate all the v Latin letters or treatments precisely once in each row and / or each column, leading thereby to a situation where each row and / or each column may have less than v Latin letters or treatments appearing in them. In other words, there would be empty nodes in the Latin square arrangement and the Latin square design, meaning thereby that the row-column design is a non-orthogonal design with treatments vs rows and / or treatments vs columns classifications as non-orthogonal. Balanced incomplete Latin square designs have been introduced for such situations. A balanced incomplete Latin square design with parameters v and r is an incomplete Latin square of order v such that each row and each column has $r < v$ non-empty cells and v-r empty cells and each of the v symbols appears exactly r times in the whole square. Henceforth, we shall denote a balanced incomplete Latin square with v symbols and r replications of each symbol as BILS (v, r). Here the term 'balanced' implies that each row and column has same number of non-empty cells and each symbol has same number of replications in the whole square. This balance is neither related to pair-wise balance nor variance balance. Here, construction of BILS (v, r) is done by removing the v-r disjoint transversals from a Latin square of order v via a pair of orthogonal Latin squares. Here, a transversal in a Latin Square of order v is a set of v cells such that only one cell is allowed in each row and in each column, and furthermore, each symbol can appear in each cell once. A module for online generation of Balanced Latin square designs for all values of $3 < v < 21$ (expect v = 6, 10,14, 18) have been developed and made available at www.iasri.res.in/design/BILS_Design/Default.aspx.

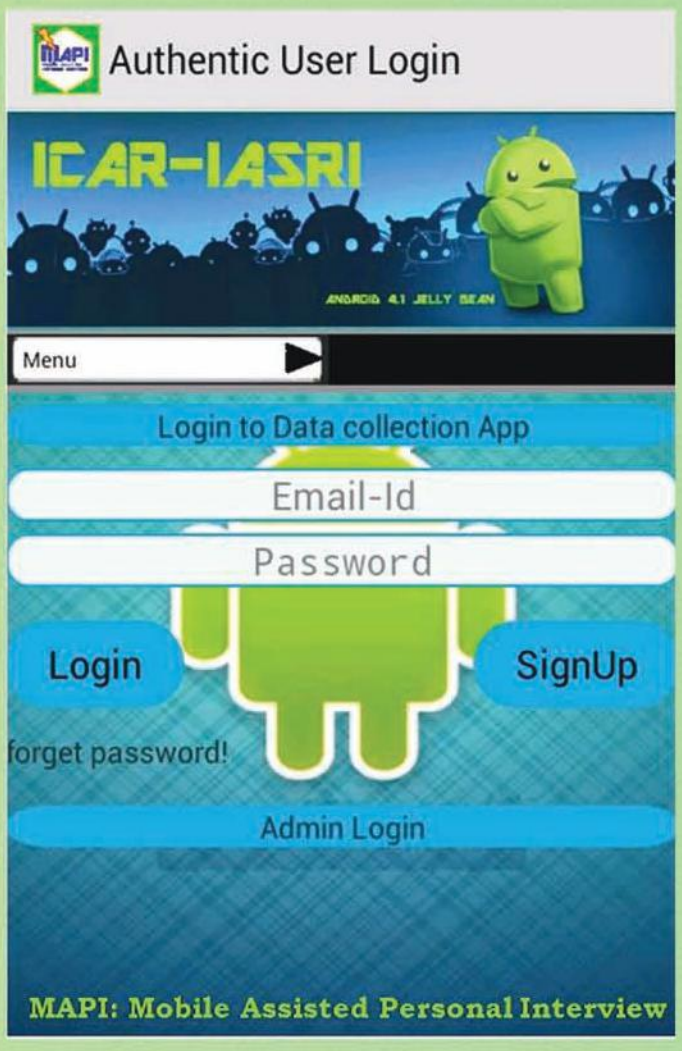
Row-Column Designs in 2 Rows for Orthogonal parameterization

Row-column designs are useful for the experimental situations in which there are two cross classified sources of heterogeneity in the experimental material. In many experimental situations due to practical considerations, it may not be possible to accommodate more than two experimental units

in a column of a row-column design. Row-column designs with two rows and with factorial treatment structure have also been found useful in many agricultural experimental situations including two-coloumn microarray experiments. When the design is non-orthogonal in a row-column set up, it would be desirable that it permits orthogonal estimation of all factorial effects with high efficiency. This may require a large number of columns. Due to cost and time considerations, it may not be possible to run a design in number of runs that are required for orthogonal estimation of all the factorial effects. The experimenter may, however, be interested in orthogonal estimation of all the main effects and two factor interactions based on an orthogonal parameterization. A module has been developed for online generation of Row Column Designs with equal replication of each treatments for Factorial Experiments in Two Rows for $2n$ (n<10) factorial experiments for orthogonal estimation of main effects and two factor interactions. Here, for each factor, two designs are generated, one in which main effects are estimated with more efficiency. Online generation module also generates designs with unequal replications in the same parametric range for orthogonal estimation of main effects and two factor interactions. Here one can obtain designs with fewer numbers of columns as compared to the minimum number of replications required for orthogonal estimation of main effects and two factor interactions in equi-replicated designs. This module has been made available at http://www.iasri.res.in/design/Row_Column_design_OP_2_rows/Default.aspx.


Home | Copyright | Disclaimer | Hyperlinking Policy | Sitemap | ContactUs
Screen Reader Access Skip to main content
SAMPLE SURVEY RESOURCES SERVER
Home
E-Learning
Ask A Question
ArchiveofQuestions
Discussion Board
Software
Android AppNEW
FAQ's
Contact Us
2016/06/27 Mon 07:57:03 PM
wser.
Sample Survey Resource Server is a web resource created with a goal to disseminate research in theory, application and computational aspects of sample survey among the statisticians in academia,practicing statisticians involved in advisory and consultancy services, scientists in the National Agricultural Research System, and the statisticians involved in conducting large scale sample surveys, particularly in the National Statistical System with focus on agricultural statistical system.This resource focuses on propagating research in sample survey including designing a survey, estimation procedures with support of online software for computing purposes, analysis of survey data, e-learning, etc. This resource is useful to surveyors in agricultural sciences, biological sciences, social sciences, industry and in statistical organizations in the centre and the states in planning and designing surveys and then in analysing the complex survey data generated. One important feature of the resource is the Discussion Forum that aims at providing online advisory and consultancy to the surveyors in general and surveyors in agriculture in particular. This forum also provides a platform to establish a network of statisticians, survey statisticians and survey practitioners. Another important feature of the resource is the link "Ask a Question" through which the user can ask questions and seek clarifications through Email.
The ultimate objective of this resource is to provide e-advisory services. Electronic books on theory of sample surveys and survey data analysis techniques with emphasis on agriculture are also available on this resource.
An online software package is available for the analysis of survey data. It is expected that the material provided at this server would help the survey practitioners in general and in agricultural sciences in particular and those survey practitioners involved in planning,
Search SSRS site...
SAMPLE SIZE CALCULATOR
Estimation of Population Mean
Estimation of Population Proportion
An Interesting Reading
History of Statistics on Timeline


IASRI-Sample Survey
ICAR - IASRI
Android App For Data Collection
Ver. 4.1
LOADING.....
Division of Sample Surveys
ICAR-Indian Agricultural Statistics Research Institute
New Delhi-12


Authentic User Login
ICAR-IASRI
ANDROID 4.1 JELLY BEAN
Menu
Login to Data collection App
Email-Id
Password
Login
SignUp
forget password!
Admin Login
MAPI: Mobile Assisted Personal Interview

Technology Assessed and Transferred

- A new sampling methodology for estimation of cotton production using double sampling approach under stratified two stage sampling framework, which is efficient and very cost effective than the existing methodology in operation has been implemented in all the Cotton growing states of the country from 2015-2016 by Directorate of Economics and Statistics (DES), Ministry of Agriculture and Farmers Welfare, Govt. of India.
- A new sampling methodology for estimation of area and production of horticultural crops which is efficient, simple, less time consuming and cost effective is being validated in eight states of the country namely, Karnataka, Maharashtra, Tamil Nadu, Andhra Pradesh, Gujarat, Himacal Pradesh, Haryana and Madhya Pradesh under CHAMAN Project (2014-2017). After validation of the developed methodology, the developed methodology will be implemented in all the states of the country from 2017-2018 by Division of Horticulture, Department of Agriculture, Cooperation and Farmers Welfare (DAC&FW), Ministry of Agriculture and Farmers Welfare, Govt. of India.
- A suitable sampling methodology for estimation of quantitative harvest and post harvest losses of major crops/commodities in India developed during previous study was implemented for conducting a National level survey during 2012-2014 covering 120 selected districts of the country and reliable estimates of percentage loss for 45 crops/commodities at different stages/channels i.e. from production to consumption were obtained.
- A sampling methodology for estimating crop area, yield and production under mixed and continuous cropping developed under FAO project is being tested and validated in three different countries namely, Indonesia from Asian Region, Rwanda from African Region and Jamaica from Caribbean Region during December 2015-April 2016. The developed sampling methodology is likely to be adopted globally specially in developing countries in future by the Food and Agriculture Organization of United Nations.
- Method of sampling of imported fertilisers from ships and containers being followed as per the prescribed procedure in the Fertiliser Control Order (FCO), Govt. of India was studied and modified method of sampling was suggested so that the sampling is done with reliability and it is practically feasible also. The modified method of sampling of imported fertilisers from ships and containers is adopted and included in Fertiliser Control Order (FCO), Govt. of India published in 2015.
- An andorid based Mobile Assisted Personal Interviewing (MAPI) Software has been developed under the project “Pilot study for developing State level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanathan Committee report” for data collection using smart phones with android operation system. It has been deployed in the State of Uttar Pradesh for data collection work in the Rabi season 2015-2016.

- A data entry software has been developed under the project "Pilot study for developing State level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanathan Committee report" for digitization of the primary data collected. It has been deployed in the state headquarters of the four states being currently surveyed namely Assam, Uttar Pradesh, Odisha and Karnataka.
- KRISHI (http://krishi.icar.gov.in/) Knowledge based Resources Information Systems Hub for Innovations in agriculture portal has been launched as a centralized data repository system of ICAR consisting of Technology and Data.
- For easy accessibility and quick reference of factorial experiments with minimally changes run sequences by the experimenters, webFMC online software (http://webfmc.iasri.res.in) has been developed. This software provides freely available solution for the researchers and students working in this area. The software generates both symmetric and asymmetric factorial design with minimum number of level changes for any parametric combinations.
- A module for online generation of Balanced Latin square designs for all values of $3 < v < 21$ (except v = 6,10,14, 18) have been developed and made available at www.iasri.res.in/design/BILS_Design/Default.aspx.
- A module for on-line generation of Row Column Designs with equal replication of each treatments for Factorial Experiments in Two Rows for $2n$ (n<10) for orthogonal estimation of main effects and two factor interactions has been developed and made available at http://www.iasri.res.in/design/Row_Column_design_OP_2_rows/Default.aspx .
- A web application has been developed to predict the donor splice sites in vertebrates (http://cabgrid.res.in:8080/sspred/)
- SBMDb: First whole genome putative microsatellite DNA marker database of sugar beet for bioenergy and industrial applications has been developed (http://webapp.cabgrid.res.in/sbmdb).
- BIS-Goat: Breed Identification Server for Goat with locus minimization has been developed (http://nabg.iasri.res.in/bisgoat)

Education and Training

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

Degree Courses

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

(i) Ph.D. (Agricultural Statistics)

(ii) M.Sc. (Agricultural Statistics)

(iii) Ph.D. (Computer Application)

(iv) M.Sc. (Computer Application)

(v) Ph.D. (Bioinformatics)

(vi) M.Sc. (Bioinformatics)

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

DISSERTATIONS APPROVED

Ph.D. (Agricultural Statistics)

i) Sankalp Ojha
Chairperson: Dr. LM Bhar

Outliers in Designed Experiments with Correlated Errors

In designed experiments, the assumption of independence of observations gets violated because of various types of dependence among the observations within a block viz. autoregressive, moving average type and equi-correlation. Also the departures from the basic assumptions may take place in presence of disturbances like outlier(s). In the present study an attempt has been made to tackle outliers in block designs with correlated errors. Mainly, Cook-statistic and AP statistic are developed in general for any *t* outliers. Simplified expressions are obtained for the case of a single outlier and the case of two outliers. Two types of correlation structures in each block have been considered. One is auto-regressive [AR(1)] and the other one is equi-correlation structure. Developed statistics are illustrated with real experimental data. Tackling of multiple outliers is very difficult owing to the presence of masking. Following the logic used in linear regression model, two methods have been developed for detecting outliers in presence of masking. One method is based on the eigenvalues of a well defined influence matrix and the other one is based on conditional Cook-statistic. Both the methods

are also illustrated with real experimental data by considering the above mentioned two correlation structures. Another way of tackling outliers is to adopt a design that is insensitive to the presence of outliers. Such designs are called robust designs. In the present study, a robustness criterion has been proposed for block designs with correlated errors. Block designs for one-way elimination of heterogeneity that are robust by this criterion have been identified. However, only equi-correlation structure in each block has been considered for identifying the robust designs.

ii) Anindita Datta
Chairperson: Dr. Seema Jaggi

Generalized Row-Column Designs for Single and Multi-Factor Experiments

In field and animal experiments, where there are two sources of variation in experimental units that may influence the response variable, row-column designs are used. Most of the row-column designs developed in the literature have only one unit corresponding to the intersection of row and column. However, for the instances when the number of treatments is large with limited experimental resources, Generalized Row-Column (GRC) designs are used where there is more than one unit in each row-column intersection. The GRC designs developed in the literature are to study all possible pair-wise treatment comparisons. There may arise experimental situations where it is desired to compare treatments belonging to two disjoint sets and the interest is to estimate the contrasts pertaining to treatments from different sets with as high precision as possible. Balanced Bipartite Generalized Row-Column (BBP-GRC) designs have been defined and series of BBP-GRC designs have been developed in which the contrast of first set versus second set of treatments is estimated more precisely. The presence of missing observations, outliers in the data, etc. are some of the disturbances that may occur during experimentation. These disturbances may lead to less precise comparisons among treatments. Robustness of different classes of GRC designs against missing of one or more observations has been investigated. It is found that the efficiency is quite high (more than 90%) for most of the designs and the designs are robust and there is a decreasing trend in efficiency with increase in number of missing observations. The GRC designs developed in the literature are mostly for single factor experiments. Situations may arise wherein the experiment consist of more than one factor with each factor having more than one levels. Generalized confounded row-column (GCRC) designs, generalized partially confounded row-column (GPCRC) designs and fractional GCRC designs have been developed which ensure that all lower order interactions including main effects are estimable. For easy accessibility of GRC designs, a web solution named WebGRC has been developed that provides the online generation of randomized layout of these designs along with an online catalogue within a permissible range.

iii) Ram Kumar Choudhary
Chairperson: Dr. AR Rao

Multi-Location Trials and Genomic Data Analysis in Perennial Crops Exhibiting Bienniality

Most of the perennial fruit crops, like mango exhibit biennial rhythm in fruiting, i.e. it bears heavy fruiting in one year called ‘on’ year and less or no fruiting in the next year called ‘off’ year. Due to bienniality, growers are facing economic loss during ‘off’ year with poor yield or no yields and selling of heavy yield at low price during ‘on’ year due to oversupply in the market. Detection and quantification of bienniality is important to assess the amount of risk. There is a need to select genotypes which can bear fruiting consistently over the years or select the genotypes after eliminating bienniality through proper treatment. Multi-Location Trials (MLTs) are being conducted for performance testing of the genotypes over environments. However, the perennial crops which exhibit biennial rhythm may mislead the selection of genotypes unless the bienniality is removed through suitable statistical procedures. Besides, some of the observations of MLTs data are missing due to disease and pest attack, adding or dropping of genotypes from year to year, bad weather etc. This leads to a situation involving incomplete genotype x environment data matrix. Identification of superior genotypes remains a challenging task in the presence of bienniality under complete/

incomplete genotype ´ environment data situations that too when trials are conducted over years. The AMMI model which is widely used model to study stability of genotypes for selection may not be suitable to deal with in the presence of bienniality. Also, there is a need to device procedures to handle the incomplete data situation for the selection of genotypes in presence of bienniality. In this study, a moving average approach has been adopted to eliminate bienniality factor in the AMMI model. In order to show the effect of bienniality on selection of genotypes, the correlations between ranks of genotypes assigned based on the performance of yield, stability variance and simultaneous selection indices prior to elimination and after elimination of bienniality were estimated. It was found that the estimated correlations have deviated from unity due to the effect of bienniality. The results have been verified through simulation and assessed the changes in genotype ranking as well as in the proportion of genotypes selected in the top 50% of the total genotypes under real data situation. Also, the biennial bearing tendency in mango for the trait "*number of fruits per tree*" has been confirmed in the real data collected from AICRP-STF, Lucknow. The 'Mallika' genotype of mango consistently exhibited the bienniality over locations followed by Dashehari and Kishan bhog genotypes. Further, the trait was found to be moderate to highly repeatable. The results also reveal that the effect of bienniality increased on the rank correlation of genotypes evaluated on the basis of simultaneous selection indices with increased weightage on stability component. Thus, selecting genotypes in MLTs in the presence of bienniality is recommended after eliminating the bienniality from the data. The application of EM-AMMI procedure in the presence of bienniality was found to be more robust than FITCON against increasing rate of missing observations. The results reveal that EM-AMMI can be safely used up to 10% missing observations. With the advent of next generation sequencing technology huge amount of genomic data are available in public domain. Since, mango proteomics has not been fully explored, the genes responsible for bienniality need to be identified through omics approaches. Twenty nine *putative* genes responsible for mango bienniality have been identified by *in silico* methods and a database consisting of genic/ genomic information has been developed. Moreover, 'Arginine' amino acid residue has been identified as a key conserved residue possibly responsible for bienniality in mango. The phylogenetic analysis revealed that most of the bienniality responsible genes of mango have shown close relationship with that of apple. The three dimensional structures of bienniality responsible genes were predicted from functionality view point. A new distance measure has also been proposed to compare any two 3D protein structures.

M.Sc. (Agricultural Statistics)

i) Sushil Kumar
Chairperson: Dr. Hukum Chandra

Some Investigations on Small Area Estimation of Proportions using Unit Level Survey Data

Sample surveys are usually planned to produce reliable direct estimates for larger domains or areas and are not appropriate to produce small area statistics due to small sample sizes. Small area estimation (SAE) techniques are used to produce reliable estimates for such areas or domains. Binary data are often of interest in surveys. When small area estimates are required for such binary data, use of standard estimation methods based on linear mixed models becomes problematic. In this case, generalized linear mixed model with logit link function is often used in SAE and the empirical best predictor (EBP) approach is widely used for the estimation of small area proportions under this model and proven to be efficient as well. However, the EBP requires the availability of population level auxiliary data. Sometimes population level auxiliary data is either not available or not consistent with the survey data. As a result, EBP approach cannot be used. We propose three small area predictors for population proportion under generalized linear mixed model with logit link function based on availability of level of auxiliary information. The performance of proposed method of SAE was evaluated through simulation studies. In the simulation studies, both generated data under the model and the real data from the National Sample Survey Office survey was used. The

results clearly indicated that the developed method of SAE works well for generating the estimates of small area proportions and represents a practical alternative to the EBP when population level auxiliary data is known.

ii) Sumeet Saurav
Chairperson: Dr. Cini Varghese

Statistical Design for Multi-Session Sensory Trials in Food and Nutrition

Sensory trials are included as an integral part of food and nutrition experiments involving agricultural/animal produce to demonstrate some sensory fact. In order to draw definite conclusion from the study, it is important to eliminate or minimize all sources of error, recognize and control all factors that may influence or interfere with the result. In addition to the potential sources associated with the preparation of the test products, there is variability due to measurement or assessment process, order effects and carryover effects. In sensory trials involving large number of products, there are mainly two operational constraints that limit the choice of experimental design. On one hand, the assessor constraint sets a maximum number of products that an assessor can evaluate within a session before onset of sensory fatigue. On the other hand, preparation constraint limits the number of products that can be prepared for a given session without loss of experimental control. Therefore, it is many times necessary to split sensory evaluations into sessions. Three general methods to construct designs for multi-session sensory trials with/without carry over effects are developed. Sometimes, designs are required that provide higher precision estimates for the crucial product comparisons, at the expense of the comparisons of lesser interest, which will be estimated with lower precision. One situation where there is special interest in a subset of product contrasts arises when control products are included in the trial. A control product may also be helpful to the panel as it provides a calibration standard, which provides a basis for comparison of results across studies. Thus, three series of treatment vs. control designs for multi-session trials are obtained to deal with such situations. Also, SAS programs are developed to calculate variances and efficiency factors of various designs obtained.

iii) Shyamsundar Parui
Chairperson: Dr. Rajender Parsad

Construction of Latin Hypercube Designs

Latin hypercube designs (LHD) are widely used as space-filling designs in the field of computer experiments. Choice of a good LHD closely depends upon space-filling and orthogonality criteria. Space-filling criterion provides maximum coverage to the whole design space and orthogonality criterion helps to estimate effects independently. These two criteria are not dependent upon each another. A good space-filling LHD may not be orthogonal and vice-versa. So efforts are directed to two different directions to obtain LHDs. One is to find LHDs for good space-filling and another is to find orthogonal Latin hypercube designs (OLHD). A method has been developed for construction of LHDs for two factors and any number of runs which provides good space-filling property. Space-filling values of Latin hypercube (LH) from proposed method are compared with LH obtained from methods available in literature and LH obtained from JMP software. LHs from proposed method provide good space-filling property in terms of small runs with two factors. Methods of constructing OLHDs for two and three factors have also been developed for any number of runs for which OLHDs can exist. OLH of 8 and 9 runs with three factors have same space filling property with that of the best designs obtained by taking all possible three columns combinations from 8 and 9 runs with 4 factors OLH. Catalogues have been prepared with complete list of designs and their space-filling values up to 20 runs for both the cases viz. LHD with good space filling properties and OLHDs.

iv) Rahul Banerjee
Chairperson: Dr. KN Singh

Pre-Harvest Forecasting of Crop Yield using Detrended Yield: A New Approach

Crop yield forecast models have been developed using weekly data on weather variables such as maximum temperature, rainfall, minimum temperature and relative humidity. Detrended yield approach has been used for developing the forecast models. Time series data on the yield of Wheat crop *(Triticum aestivum)* in five districts of Uttar Pradesh

namely, Lucknow, Kanpur, Banda, Jhansi and Faizabad was taken which were subsequently treated as the dependent variable and weekly data on the weather variables (weather indices) were used as the regressor variables in the model. The yield was detrended by obtaining the parameter estimates of the model and subsequently the detrended yield was used to forecast the yield of the crop using Autoregressive Integrated Moving Average (ARIMA) model. The proposed method of obtaining Pre-harvest forecasting of yield of crops was compared with the traditional approaches of forecasting and the proposed method was evaluated in terms of criterion such as goodness of fit of the model which was evaluated using standard statistical measures such as Mean Square Error, Mean Absolute Error and the Relative Mean Absolute Error and the forecasting performance of the proposed model was also developed using statistical measures such as Mean Squared Prediction Error (MSPE), Mean Absolute Prediction Error (MAPE) and Relative Mean Absolute Prediction Error (RMAPE). It was observed that in all the districts, the proposed model performed better as compared to the traditional method both in terms of goodness of fit as well as forecasting performance as the values of this measures were lower for all the districts as compared to the traditional approach for modeling as well as for forecasting the yield of the crop.

v) **Nitin Varshney**
Chairperson: Sh. SD Wahi

Discrimination of Coding and Non-Coding Regions in Cattle based on Epigenetic Mechanism

In the present study, discrimination of coding and non-coding regions of cattle genome, collected from the UCSC Browser, has been done based on Epigenetic Mechanism. The CDS as well as the intron sequences were divided into the training set that comprised 80% of the sequences whereas the rest of the sequences are retained in the test set. Intron sequences are encoded by using different indices meant for DNA methylation and spontaneous deamination. Content sensors that can discriminate between CDS and introns, based on the sequence pattern created by DNA methylation. Five different indices namely Deviation of Nucleotide, Deviation of Dinucleotide, Intensity of methylation effect, Triplet avoidance index and tendency of Polypurine and Polypyrimidine that could encode exon and intron sequences have been used. Dispersion matrix was estimated based on the performance of the five indices in the training set. PCA is performed and PC scores are computed for both the CDS as well as the intron sequences in the training set. On the basis of length in base pairs the sequences have been classified into six different categories viz. $L_{0.1}, L_{0.2}, L_{0.3}, L_1, L_2, L_3$ and the number of CDS as well as intron sequences in each of the six categories have also been evaluated and the category containing the largest and the smallest number of CDS as well as intron sequences also has been found out. The relative abundance of the five indices has also been worked out in the three categories. The area under the ROC and the PR curve along with their standard errors were also computed. The proposed method has been compared with the methods based on LDA and QDA based on the area under the ROC and the PR curves, whereby the proposed method proved to be better as compared to LDA and QDA.

vi) **Rajeev Kumar**
Chairperson: Dr. Rajender Parsad

Polygonal Designs for Sampling from Naturally Ordered Populations

Balanced sampling plans excluding adjacent units {BSA(m) plans} are useful for sampling from populations in which the nearer units provide similar observations due to natural ordering of the units in time or space. The ordering of units in the population may be circular or linear. For BSA(m) plans, all the first order inclusion probabilities are equal whereas second order inclusion probabilities for pairs of adjacent units at a distance less than or equal to m are zero and constant for all other pairs of non-adjacent units which are at a distance greater than m. An important series of incomplete block designs called polygonal designs are useful for obtaining BSA(m) plans. Considering the blocks of polygonal designs as samples and the treatments as units, a BSA(m) plan can be obtained by assigning equal probability of selection to the blocks. The computer algorithm based on linear

integer programming approach available for generating efficient binary incomplete block designs has been modified for obtaining polygonal designs for both the circular and linear ordered structure of population units. Computer aided search of polygonal designs is made in the parametric range $v \leq 30$, $k \leq 5$, $m \leq 5$. In this range, 1037 designs satisfy the parametric relations for circular ordering of units and 817 for linear ordering of units. Computer aided search gives almost all the existent polygonal designs except 34 designs in case of circular ordering of units and 22 designs in case of linear ordering of units. Further, 9 new polygonal designs for the situation in which units are arranged in circular order and 14 new polygonal designs for the situation in which units are arranged in linear order are also obtained.

vii) **Pankaj Das**
Chairperson: Dr. AK Paul

Estimation of Growth Parameters using Non-Linear Mixed Model and Comparison with Fixed Model in Animals

A growth model defines the mathematical relationship between size of an organism and a unit of time. Repeated measurements designs are mostly used in animal experiment as there may be correlation among repeated measurements of an individual. In case of longitudinal growth data, there are within and between individuals variation. The variability between individuals are not included in fixed effect model. The problem can be solved by using non-linear mixed effect models (NLMM). NLMM have flexible covariance structure to handle unbalanced data, estimates the random covariates and control autocorrelation in repeated measures. It also provides a scope for multiple sources of heterogeneity in data by including random effects in the models. In this study, growth data of Goat and Pig has been used. Attempt has been made to develop the Von-Bertalanffy mixed model. Logistic, Gompertz and Von-Bertalanffy fixed and mixed models have been explored for these data. Comparison of the models i.e. between fixed and mixed type of the same model and among different fixed and mixed models has been attempted. The goodness of fit statistics *i.e.* Mean Square Error (MSE) and Root Mean Square Error (RMSE) of the fitted models has been computed. The parameters of the best fitted models along with their corresponding standard error are estimated. Logistic mixed effect model is found to be the best for the Goat and Pig data. The prediction of this model is also better.

viii) **Moagisi Innocent Ithuteng**
Chairperson: Dr. LM Bhar

Time Series Regression of Aphid Count Data

Aphid population data on mungbean crop from five different locations of India, viz., Pantnagar, Behrampur, ICAR-IARI, Mohanpur and Bharatpur farms along with the meteorological data on rainfall, maximum temperature, minimum temperature, maximum relative humidity, minimum relative humidity, sunshine hours, wind speeds etc. for December, January, February, March, and April from 2001 to 2004 have been used to fit various models appropriate for modeling pest count data. It has been found that results obtained through negative binomial (NB) model are the best among other models considered, viz., OLS and Quasi-Poisson models. Even though OLS was performing better than Quasi-Poisson in terms of forecasting performance, still OLS model cannot be used to predict time series count data as this violated its assumptions, hence the regression coefficients estimates are questionable. On the other hand the Quasi-Poisson model produced highly erroneous significance tests for the coefficients that some explanatory variables are significantly related to aphid rates while the NB didn't show any significance. The problem of over-dispersion associated with aphid counts was more addressed in NB regression model as there was evidence that NB was fitting better than Quasi-Poisson and OLS models in all the locations. Based on AIC and BIC scores, NB was chosen as the better fitting model. Regarding statistics for evaluating the forecasting performance, the NB model had the smallest statistics followed by OLS and Quasi-Poisson model was clearly inferior to all other fits. Finally, most of explanatory variables included in the models were not statistically significant in predicting the aphid counts. The use of DM test also support the claim that

the NB model outperforms Poisson and OLS regression as far as modelling and forecasting of aphid pest count is concerned.

M.Sc. (Computer Application)

i) Surchand Mayanglambam
Chairperson: Dr. Rajni Jain

Software for Agricultural Productivity Analysis

Productivity growth in agriculture has become a serious issue over the last five decades. Analysis of agricultural productivity data of different regions can help to find factors affecting the growth of productivity. There is a wide difference in the agricultural performance within state due to its variation in resource available, climatic, topography etc. so district level study of agricultural data will be a step to give a better result. Keeping in pace with the development of the internet technology, there is need to develop web based data analysis tools in agriculture research. Therefore, Software for Agricultural Productivity Analysis (SAPA) was required. The software is completely menu driven and offers user-friendly screens to reduce efforts in understanding the software. User can register, login, analyze agricultural productivity and can save result in Excel file. Software results are validated using a suitable dataset.

ii) Niranjan Nayak
Chairperson: Dr. Alka Arora

Development of a Web Enabled System for Estimation of Canal Water Availability in a Selected Area

The Indian farming community is facing a lot of problem in increasing the crop production. Water is one of the major factors that influence the crop cultivation or crop production. Conservation of water is becoming increasingly important. Farmers rely on irrigation and canal irrigation is important component of the same. Canal irrigation system consists of network of canals which include main canal, distributary canal, minor canal and outlets. The source of water to main canal could be river water or water stand reservoir. From the sources water is released to main canal then it goes to distributary canal after that it goes to minor canal then to the field through outlet. Not all the water released in the main canal at river water reaches to the farmer's field. A considerable portion of water released in main canal is lost in the form of seepage when it is flowing through the different canal. From irrigation point of view, the water that is available at field level is important. Normally the water available at the field level is estimated manually using the various methods to accomplish seepage losses. An online software has been developed to account for seepage losses for estimating the water available at the field level. This system has been developed using standard three tier web architecture. The client side interface layer has been implemented using HTML, CSS and JavaScript. The server side application layer has been implemented using JSP technology and the database layer has been implemented using Microsoft SQL server. This software provides information about the seepage loss for the main canal, distributary canal, minor and outlets. The system also provides how much water is available at the field level and the time taken to irrigate the field. This system can serve the Dam managers by providing them information about the seepage loss calculation, water available at field level and time taken to irrigate field.

iii) Saravanakumar R.
Chairperson: Dr. Rajni Jain

Web Based Application for Apportioning Temporal Data at District Level

Agriculture performance generally differs widely within state due to varying regional characteristics in terms of resource endowments and climate. Apportioning is an important process to distribute or allocate with proportion obtained from geographical area over three decade of time period. Methodology for apportioned data for district is not available in any format in any software or in documented form. Therefore, a need for web based application for apportioning temporal data at district level was felt and attempt was made to develop the user friendly online software. User can register, login, Apportion district data, and can see the results and save data in excel file for future use. Administrator interface of the software helps in development and maintenance of user database. Software results are validated using real data.

iv) **Mayanglambam Subashchandra Singh**
Chairperson: Dr. Alka Arora

Online Software for Forewarning of Onion Thrips

Onion, *Allium cepa* is important vegetable crop and onion thrips is most damaging pest for this crop. Timely forecast can help in taking remedial measures for the same. Statistical models have been developed at ICAR-IASRI based on weather parameters for forecasting different aspects relating to thrips. The models have been developed for different planting dates for the data taken from ICAR-DOGR. Models have been developed for thirteen dates of sowing for the forewarning of crop age at first appearance of thrips, crop age at peak population of thrips and maximum thrips population. The models have been tested and used by DOGR for forewarning purpose. To disseminate the information in effective manner, online software has been developed based on the weather models. Online system for Onion Thrips Forewarning System (OTFS) has been developed using three-tier architecture. Client layer is implemented using Hypertext Markup Language (HTML), Cascading Style Sheet (CSS) and Java script. In application layer all the programing for models have been done using Java Server Pages (JSP). Database layer for storing the weather data has been implemented in Microsoft SQL Server. User can access the system using web browser. Administrator is another user to whom access rights for data management has been provided. Administrator can upload the weather data in excel sheet to the system. Results have been validated by running the models in SAS software and online software. The developed system will help the farmers, agro-advisors and agricultural extension personnel in forewarning of disease in a timely manner.

v) **Ipshita Roy Chowdhury**
Chairperson: Dr. Anshu Bharadwaj

Web Based Tool for Interpolation of Climate Data

In agriculture and environmental planning, climate plays a very important role. It is a measure to learn the relationship between biological and environmental phenomenon. Developing countries like India are facing the problem of lack of accurate climate data. This problem affects integrated planning on the environment and agriculture. Agricultural and natural resource management activities require the understanding of spatial variation in climatic conditions. Estimates of climatic variables which are spatially distributed are required for use in geographical information systems and models. This means that the effectiveness of agricultural research depends on the techniques which can handle variability in crop and soil, weather parameters and spatial interpolation, that represents estimation of value of data points at the sites from where no sample is drawn and it is in an area which is already known with sampled points, by using the data obtained from the sampled points. There is necessity of accurate and inexpensive quantitative approaches to interpolate climate data in developing countries. Climate data in India is acquired from the weather stations located at different locations in each state. In India, when required climate data for the locations where no weather stations are located, the average (mean) of the climate data from the surroundings locations is considered. Each state doesn't have enough weather stations to even cover each district. (e.g Uttar Pradesh (UP) has 75 districts and only 47 weather stations. Source: IMD). Interpolated climate data is a necessity for better planning, forecasting and research related to global climate change scenario. Some softwares have already been developed and are being used for interpolating climate data but these are all either stand alone or have been developed for specific locations. Thus, a web based tool for interpolation of climate data was needed which can help researchers, students and ecological workers to have an access to the data at unsampled locations for their respective works. The present study was, therefore taken upon to design and develop a Web-based Tool to interpolate the climate data. In this system, the geo-statistical method of local interpolation i.e. kriging has been used.

vi) **Murari Kumar**
Chairperson: Mohammad Samir Farooqi

Developing Agents for Bibliographic Data Retrieval St

Bibliographic records are used quantitatively by a "Bibliometrician" for analysis and

dissemination purpose but with the increasing rate of literature publication in open access journals such as Nucleic Acids Research (NAR), Springer, Oxford Journals etc., it has become difficult to retrieve structured bibliographic information in desired format. A digital bibliographic database contains necessary and structured information about published literature. Bibliographic records of different articles are scattered and resides on different web pages. This work presents the retrieval system for bibliographic data of NAR at a single place. For this purpose, parser agents have been developed which access the web pages of NAR and parse the scattered bibliographic data and finally store it into a local bibliographic database. Based on the bibliographic database, "three-tier architecture" has been developed to display the bibliographic information in systematized format. Using this system, it would be possible to build the network between different authors and affiliations and also other analytical reports can be generated.

vii) PN Somana
Chairperson: Mr. Shah Nawazul Islam

A Web Based Information System for Agricultural Equipment and Products

India being a large and diverse country with a majority of the population dependant on agriculture and allied activities, the availability of information regarding latest agricultural products, technologies and inputs to the farmers is of vital importance. Information is key to better production and productivity as a large percentage of the farmers in rural areas still follow traditional inefficient products and practices resulting in less remunerative returns. A web based information system will greatly help farmers seeking relevant information regarding products and the traders selling such products. The specific information provided aims to improve operation, better management and easier decision making. Indian Council of Agricultural Research (ICAR) has come up with a single window delivery system for services and products of research of agricultural research institutes all over the country called the Agricultural Technology Information Centre (ATIC). They provide farmers with the latest agricultural innovations and products developed at their respective research institutes. But the information on such centres is not easily available to farmers. Information about the various products available at such centres needs to be disseminated to the rural areas. Utilization of fast expanding internet services as a medium of information transfer will greatly help farmers in remote locations of the country. This thesis presents the design and development of a web based information system which provides information on prices of seeds and planting material of latest varieties and hybrids, advanced agricultural equipments being developed by ICAR and traders of agricultural commodities.

(viii) Sanober Alam
Chairperson: Md. Shah Nawzul Islam

Development of Distributed Framework for Crop Protection

India is the second largest populated country in the world. Its population is continuously increasing and is expected to reach 1.396 billion by 2025. In the near future, the production of agricultural commodities must be increased, to meet the food requirement of increasing human population. For this, crop protection plays an important role in increasing the yield of crop by identifying the disease, insect and weed infestation and also suggests several treatment and control measures to protect the crop from all these threats. In India, around 30% losses occur in crop due to these pests. Number of information systems and expert systems for different crops are already operational. These information systems and expert systems provide an information on various aspects of crop protection to farming community. The user has to access different expert systems for different crops, so there is a need for building a single window application to provide disease, insect and weed advisory on multiple crops at the same place. For this reliable distributed framework has been developed. A distributed framework is a framework which captures, stores, retrieves, manipulates and displays information from different sources. The fundamental purpose of a distributed framework is to access data from different sources that is logically related and physically distributed. This thesis presents the design and development of distributed framework for crop protection which provides

disease, insect and weed related information from different sources at a single place of wheat and several spices crop. These information will help the farmer in identifying disease, insect and weed infecting the crop and will also suggests control measure to protect the crop from all these threats. The developed system also consists of a form based alert system which provides an online form in which the farmer has to fill some detail. On the basis of temperature, humidity and rainfall value provided by the farmer after filling the form, it gives an alert about the disease, which is going to affect the crop at that particular value.

M.Sc. (Bioinformatics)

(i) Saket Kumar Karn
Chairperson: Dr. Sudeep Marwah

Strengthening and Enhancing Microbial Taxonomy Ontology

Ontology is the latest knowledge representation technique. It is devised for the web based systems to provide the capability to deal with the semantics of the concepts in the specific knowledge domain. It has potential to be used in a distributed environment like Internet and provides the dynamic and reusable capability to the knowledge base. Ontology defines domain concept and the relationship between them and thus provides a domain language that is meaningful to both humans and machines. On the other hand, taxonomy describes real world concepts in well-defined hierarchy and exists in standard form for various knowledge domains of science. The present study deals with the taxonomy of microorganisms. The Three Domain System taxonomy is most widely adopted taxonomy in this domain. It covers Bacteria, Archaea and Eukarya domains. A Microbial Ontology has been developed for Bacteria Domain by Biswas, 2012 which covers concepts from Domain to Genus level to convert unstructured knowledge into structured knowledge. In this work, the existing ontology has been extended to cover Archaea domain up to the species level. A web based interface is also developed using N-tier architecture of web applications. Net Beans IDE 8.0, Java Server Pages (JSP), Jena and SPARQL. Jena is a Semantic Web Framework for querying and reasoning OWL ontologies, OWL editor-Protégé 3.5 has been used for building and populating ontologies. In the developed ontology, newly found microorganisms can be easily classified in microbial taxonomy by matching their characteristics. Domain experts can insert, delete and edit any new information about the microbial taxonomy. The web interface also provides search facility for finding information about the concepts and 16S rRNA sequences of various Archaea species, Information can be searched from microbial taxonomy of Archaea up to the Species level, for two Phyla, nine Classes, twelve Orders, twenty Families, sixty eight Genera, and sixty six Species. By using this software also facilities name based search for microorganism's taxonomic terms. The use of ontologies to represent the taxonomic information and the ability of the software to provide this knowledge to other applications increases the utility of this work to greater extent.

ii) Arfa Anjum
Chairperson: Dr. Seema Jaggi

Mixture Distribution Models for Differential Gene Expression Analysis

Gene expression is the process by which information from a gene is used in the synthesis of a functional gene product which may be proteins. A gene is declared differentially expressed if an observed difference or change in read counts or expression levels between two experimental conditions is statistically significant. To identify differentially expressed genes between two conditions, it is important to find statistical distributional property of the data to approximate the nature of differential genes. In the present study, the focus is mainly to investigate the differential gene expression analysis for sequence data based on mixture distribution model. Mixture model is popular because it provides a mechanism to incorporate extra variation and correlation in the data, add model flexibility and are a natural approach for modelling data that arise in multiple stages or when populations are composed of sub populations. Compound mixture distribution approach was also explored to identify the differentially expressed genes. These approaches were applied in Microarray data and RNA-seq data of *Arabidopsis thaliana*. Comparison was made between mixture distribution/ compound distribution with single

distribution with respect to the identification of differentially expressed genes. Fitting of two-component mixture normal model in case of microarray data is found to be more capable of capturing the variability as compared to single component normal distribution and hence identified differentially expressed genes more accurately. Further, it has been found that in case of RNA-seq data, negative binomial as compound Poisson distribution is more appropriate to capture the variability as compared to Poisson distribution. Thus, fitting of appropriate distribution to gene expression data provides statistically sound cut-off values for identifying differentially expressed genes.

(iii) Md. Asif Khan
Chairperson: Dr. Sunil Archak

Development of Crop Wild Relatives Resources (CWR) Database for *Vigna* and *Phaseolus* Species

Crop Wild Relatives (CWR) Resources database was developed for *Vigna* and *Phaseolus* species. Taxonomic data on 56 species, Genebank passport data on 53,870 accessions and 1,017,292 entries from GenBank (nucleotide, EST, protein and gene) were collected from different open source databases. The data were curated, compiled and arranged in six tables (Taxonomy, Germplasm, Nucleotide, EST, Protein and Gene) in relational manner using MSSQL Server. A web based graphic user interface was developed using ASP.NET and MS Visual Studio. This work constituted first of its kind in joining GenBank and Genebank data.The application identified as many as 41776 germplasm accessions whose genomic information is available in GenBank. Linking a specific gene, EST, nucleotide and protein of known functional importance to a germplasm accession is expected to assist molecular breeders in precision breeding programme in addition to adding value to the germplasm conserved in the genebanks.

(iv) Priyanka Guha Majumdar
Chairperson: Md. Samir Farooqi

Codon Usage Bias Based Comparative Genome Analysis of *Rhizobium* Species

The bacteria belonging to the genus *Rhizobium* are capable of fixing atmospheric nitrogen in symbiosis with leguminous plants by forming root nodules. These rhizobial inoculants are used as biofertilizers and act as an alternate source of nitrogenous fertilizers. But the limitation is that the Rhizobium can infect only leguminous plants and they are species specific. In this era of genetic engineering we can try to transform crops other than legumes with the novel genes of *Rhizobium* responsible for nitrogen fixation. For this we need to know the codon usage patterns of the nitrogen fixing genes in order to improve the exogenous gene expression. And that is why the study of codon usage pattern of the Rhizobium is gaining increasing attention over the times. Efforts have been made continuously to understand the codon usage patterns and identify some conserved features of the genus Rhizobium. In the present study three strains of Rhizobium namely *Sinorhizobium meliloti* 1021, *Bradyrhizobium japonicum* USDA110 and *Rhizobium tropici* CIAT899 whose complete genome sequence are available were taken from NCBI (www.ncbi.nlm.nih.gov) for the analysis of codon usage bias and further a comparative analysis was also done among these three strains and other six strains of *Rhizobium* which had already been studied for codon usage bias by other researchers. The overall codon usage analysis showed that G and C ending codons are predominant in the rhizobial genome than A and T ending codons. Nc plot revealed that translational selection along with compositional constraints are the major causes of codon usage bias. The correspondence analysis (COA) showed the first two axes mainly accounted for the variation in the codon usage data. The Pearson correlation analysis identified significant correlation between the first axes of COA and CAI and other factors of codon usage bias, which indicated that gene expression level played an important role in shaping codon usage pattern of the genus. The comparative analysis showed that the use of Cys codons varied among the different genes in the genus Rhizobium. Our study of the three strains identified 17 optimal codons that were shared among these strains. The comparative analysis finally revealed that there were 16 codons that were shared amongst them and was identified as a conserved feature of the genus *Rhizobium*.

(v) Animesh Kumar
Chairperson: Md. Samir Farooqi

Prediction of miRNA Related to Late Blight Disease of Potato

Late blight of potato is the most important fungal disease in potato cultivation worldwide, casued by *Phytophthora infestans.* Many recent studies show that microRNA (miRNA) is an important gene expression regulator in plants also it plays a very important role in host-pathogen interaction. Several methods such as forward genetics or direct cloning are available to detect miRNA which are time consuming as well as costly. Discovering miRNA related to late blight of potato through computational means is not only efficient but also helpful in understanding of plant-pathogen molecular interaction mechanisms. It provides theoretical idea to facilitate germplasm for disease resistance for the management of late blight of potato. In the present study, prediction and characterization of novel miRNA related to late blight disease were done using computational means. A total of 23571 non-redundant mature miRNA sequences from miRBase database and 262,006 whole *Solanum tuberosum* EST sequences from NCBI were used to identify 34 potential miRNA related to 6 different miRNA families. The psRNATarget server predicted 2633 potential target genes related to pre-miRNA. Most of the target genes were involved with translational and cleavage function. Later these potential target genes were annotated with geneontology (GO) terms *via*. agriGO ToolKit analysis server. All predicted GO terms were classified into 134 functional groups including biological processes, cellular component and molecular function. Out of which two distinct GO terms were related to defence response and response to stress during *P. infestans* infection. Back tracing of such GO terms reveals that they were related to 5 distinct target genes and 34 miRNA. These five target genes were involved in translational and cleavage activity. Then, 34 miRNA were screened by constructing miRNA-miRNA relationship networks out of which predicted miRNA were supposed to be related to late blight disease of potato. This work can be further supported through experimental validation. Further in-depth experimental study can disclose the role of predicted miRNA during host pathogen interaction and disease development.

National / International Training Programme

Senior Certificate Course in Agricultural Statistics and Computing

Senior Certificate Course in Agricultural Statistics and Computing was organized for the benefit of research workers engaged in handling statistical data collection, processing, interpretation and employed in research Institute of the Council, State Agricultural Universities and State Government Departments, etc. & foreign countries including SAARC countries. The main objective of the course was to train the participants in the use of latest statistical techniques as well as use of computers and software packages. The course was organized during June 22, 2015 to November 21, 2015. The Course comprised of two independent modules of three months duration each. One officer participated in both the modules. Module – I was organized during June 22, 2015 to August 22, 2015. Module-II was organized during September 01, 2015 to November 21, 2015. Three officers participated in Module – I and one officer participated in Module - II. The course covered under both the modules included Statistical Methods and Official Agricultural Statistics, Use of Computers in Agricultural Research, Sampling Techniques, Econometrics and Forecasting Techniques, Design of Experiments and Statistical Genetics.

Category	No. of Training Programmes	No. of Participants
CAFT	4	96
Resource Generation	8	143
Others	12	293
Total	**24**	**532**

Details of Training Programmes organised

S. No.	Title	Venue	Date	Sponsored by	No. of Participants
	Centre of Advanced Faculty Training				
1.	Application of Computer Algorithms and Statistical Software Packages in Agriculture Course Director : Dr. Sangeeta Ahuja	ICAR-IASRI New Delhi	18 December 2015 to 07 January 2016	Education Division, ICAR, New Delhi	25
2.	Advances for Technological Enhancement in Agricultural Research Course Director : Dr. Arpan Bhowmik Co-Course Director : Dr. Cini Varghese	ICAR-IASRI New, Delhi	19 January to 08 February 2016	Education Division, ICAR, New Delhi	25
3.	Computational Tools and Techniques for Molecular Data Analysis in Agriculture Course Director : Dr. Dinesh Kumar Co-Course Director : Dr. Mir Asif Iquebal	ICAR-IASRI New, Delhi	11 February to 02 March 2016	Education Division, ICAR, New Delhi	23
4.	Recent Advances in Statistical Genetics and Genomics Course Director : Dr. Prabina Kumar Mehar Co-Course Director : Sh. Upendra Kumar Pradhan	ICAR-IASRI New, Delhi	11 February to 02 March 2016	Education Division, ICAR, New Delhi	23
	Resource Generation				
5.	A refresher training programme on Integrated Sample Survey Methodology Coordinators : Dr. Hukum Chandra : Dr. Kaustav Aditya	ICAR-IASRI New Delhi	08-12 June 2015	Ministry of Agriculture Government of India	22
6.	Refresher training programme on Sample Survey and Sampling Design Course Director : Dr. Tauqueer Ahmad Co-Course Director : Dr. Ankur Biswas	ICAR-IASRI New Delhi	06-10 July 2015	Directorate of Economics and Statistics, Department of Planning, Government of Uttar Pradesh	18
7.	Training programme on Data Analysis and Interpretation Course Director : Dr. Rajender Parsad Co-Course Director : Dr. Arpan Bhowmik	IASRI, New Delhi New Delhi	10-22 August 2015	MoSPI, Govt. of India	40
8.	Training on Field data collection under the study Improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping	ICAR-IASRI New Delhi	31 August to 04 September 2015	FAO`	05
9.	Training programme on “Crop Cutting Experiments Technique” for the officials of Services Private Skymet Weather Services Private Ltd. Course Director: : Dr. Tauqueer Ahmad : Ms. Vandita Kumari	ICAR-IASRI New Delhi	14-19 September 2015	Skymet Weather Services Private Ltd., Noida	15
10.	International training programme on Use of Models in Crop Yield Estimation Course Director : Dr. Hukum Chandra Co-Course Director : Sh Raju Kumar	ICAR-IASRI New Delhi	02-06 November 2015	NSSTA, CSO* MOS&PI, GOI, New Delhi	08
11.	A refresher training programme on Small Area Estimation Techniques and Applications Course Director : Dr. Hukum Chandra Co-Course Director : Dr. Kaustav Aditya	ICAR-IASRI New Delhi	16-20 November 2015	NSSTA, CSO* MOS&PI, GOI, New Delhi	18

S. No.	Title	Venue	Date	Sponsored by	No. of Participants
12.	Training programme on Functions and Activities of IASRI for the participants of 69th regular term course-2015 on Official Statistics and Related Methodology of International Statistical Education Centre (ISEC) Kolkata conducted by National Statistical System Training Academy (NSSTA). Coordinator : Dr. Seema Jaggi	ICAR-IASRI New Delhi	31 December 2015	NSSTA, CSO MOS&PI, GOI, New Delhi	17
	Other Training Programmes				
13.	Designing and Analysis of Experiments for the technical personnel of ICAR Coordinators : Dr. Susheel Sarkar : Dr. Sukanta Dash	ICAR-IASRI, New Delhi	20- 25 April 2015	Education Division of ICAR	16
14.	Training programmes for the MIS-FMS project with main focus on payroll Coordinators : Dr. Sangeeta Ahuja : Sh. SN Islam	ICAR-IASRI,| New Delhi	15- 18 April 2015 11-16 May 2015 28-30 May 2015	IASRI, New Delhi	20 24 20
15.	Training programme for Payroll and HR module under MIS/FMS project Coordinator : Sh. SN Islam	ICAR-IASRI, New Delhi	22-24 June 2015	IASRI, New Delhi	18
16.	Training programme for graduate students on Statistical Analysis using Software Coordinators : Dr. Seema Jaggi : Dr. Eldho Varghese	ICAR-IASRI, New Delhi	01 June - 15 July 2015	IASRI, New Delhi	2
17.	Training programmes on Assets, Annual Account and Store under ICAR-ERP Coordinators : Dr. Mukesh Kumar : Dr. NS Rao	ICAR-IASRI New Delhi	13-15 July 2015	ICAR-IASRI New Delhi	21
18.	Training programme on Payroll and HR module Coordinators : Dr. Mukesh Kumar : Dr. Alka Arora	ICAR-IASRI New Delhi	18-21 August 2015	ICAR-IASRI New Delhi	24
19.	Training programme on Small Area Estimation Techniques. Course Director : Dr. Hukum Chandra Co-Course Director : Dr. Kaustav Aditya	ICAR-IASRI New Delhi	24-28 August 2015	ICAR-IASRI New Delhi	19
20.	Training programmes on Payroll and HR module Coordinators : Dr. Anshu Bharadwaj : Dr. Mukesh kumar	ICAR-IASRI New Delhi	01-04 September and 22-24 September 2015	ICAR-IASRI New Delhi	34
21.	Finance Module of MIS-FMS Coordinators : Dr. Mukesh Kumar : Dr. NS Rao	ICAR-IASRI New Delhi	05-07 October and 12-14 October 2015	ICAR-IASRI New Delhi	36
22.	Winter School on Bioinformatics and High Dimensional Genome Data Analysis Course Director : Dr. AR Rao Co-Course Director : Dr. PK Meher	ICAR-IASRI New Delhi	25 November to 15 December 2015	ICAR, New Delhi	20
23.	Training programme on Experimental Data Analysis for Ph.D. Students from various disciplines of P.G. School, IARI Coordinators : Dr. Seema Jaggi : Dr. Eldho Varghese	ICAR-IASRI New Delhi	07-11 December 2015	PG School New Delhi	20
24.	Training programme on Recent Advances in Next Generation Sequencing on Data Analysis under CAFT Coordinators : Dr. M Grover : Dr. DC Mishra	ICAR-IASRI New Delhi	08-18 January 2016	ICAR-IASRI, New Delhi	19

Faculty Members of PG School, ICAR-IARI in Agricultural Statistics

S. No.	Name	Year of Induction
1.	Dr. UC Sud, Director	1995
2.	Dr. VK Gupta, National Professor	1984
3.	Dr. Seema Jaggi, Professor (Agricultural Statistics)	1995
4.	Dr. Anil Rai, Principal Scientist	1995
5.	Dr. KN Singh, Principal Scientist	2011
6.	Dr. Rajender Parsad, Principal Scientist	1995
7.	Sh. S.D.Wahi, Principal Scientist	1987
8.	Dr. Lal Mohan Bhar, Principal Scientist	1998
9.	Dr. Tauqueer Ahmad, Principal Scientist	1998
10.	Dr. Amrit Kumar Paul, Principal Scientist	1998
11.	Dr. AR Rao, Principal Scientist	1998
12.	Dr. G K Jha, Principal Scientist, IARI	1999
13.	Dr. Cini Varghese, Principal Scientist	2000
14.	Dr. Himadri Ghosh, Principal Scientist	2004
15.	Dr. Prachi Misra Sahoo, Senior Scientist	2002
16.	Dr. Hukum Chandra, National Fellow	2003
17.	Dr. Anil Kumar, Principal Scientist	2010
18.	Dr. Amrender Kumar, Senior Scientist, IARI	2003
19.	Dr. Prawin Arya, Senior Scientist	2003
20.	Md. Wasi Alam, Scientist	2003
21.	Dr. Ranjit Kumar Paul, Scientist	2011
22.	Dr. Mir Asif Iqubal, Scientist	2011
23.	Dr. BN Mandal, Scientist	2011
24.	Dr. Susheel Kumar Sarkar, Scientist	2011
25.	Dr.Eldho Varghese, Scientist	2011
26.	Dr. Kaustav Aditya, Scientist	2012
27.	Dr. Bishal Gurung, Scientist	2013
28.	Dr. Sukanta Dash, Scientist	2013
29.	Dr. Arpan Bhowmik, Scientist	2014
30.	Dr. Ajit, Principal Scientist	2015
31.	Dr. Ankur Biswas, Scientist	2015

Faculty Members of PG School, ICAR-IARI in Computer Application

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

Faculty Members of PG School, ICAR-IARI in Bioinformatics

S. No.	Name	Year of Induction
1.	Dr. Anil Rai, Professor (Bioinformatics)	2010
2.	Dr. KC Bansal, Director, NBPGR	2010
3.	Dr. Seema Jaggi, Principal Scientist	2010
4.	Dr. Rajender Parsad, Principal Scientist	2010
5.	Dr. AR Rao, Principal Scientist	2010
6.	Dr. Sudeep, Senior Scientist	2010
7.	Dr. SB Lal, Scientist	2010
8.	Mohd. Samir Farooqi, Scientist	2010
9.	Ms. Anu Sharma, Scientist	2010
10.	Dr. TR Sharma, Director, NRCPB	2010
11.	Dr. T Mahapatra, Director, IARI	2010
12.	Dr. Kishore Gaikwad, Principal Scientist	2010
13.	Dr. T Napolean, Senior Scientist	2010
14.	Dr. PK Singh, Senior Scientist	2010
15.	Dr. KV Bhat, Principal Scientist	2010
16.	Dr. SS Marla, Principal Scientist	2010
17.	Dr. Sunil Archak, Senior Scientist	2010
18.	Dr. DC Mishra, Scientist	2010
19.	Dr. Sarika, Scientist	2010
20.	Sh. Sanjeev Kumar, Scientist	2010
21.	Dr. AK Mishra, Senior Scientist	2010
22.	Dr. Mir Asif Iquebal, Scientist	2013
23.	Dr. Manendra Grover, Senior Scientist	2013
24.	Dr. UB Agandi, Senior Scientist	2014
25.	Dr. KK Chaturvedi, Scientist	

Research Fellowships

During 2015 - 16, 40 Ph.D. and 37 M.Sc. students received research fellowship. 31 Ph.D. students received ICAR-IASRI fellowship at the rate of Rs. 13,125/- p.m. in addition to Rs 10,000 /- per annum as the contingent grant. 1 Ph.D. student received ICAR-SRF Scholarship @Rs.12,000/- p.m. in addition to Rs.10,000/- per annum as contingent grant. 5 Ph.D. students received Rajeev Gandhi Fellowship @ Rs.16,000/- P.M. 5 Ph.D. students received DST-Inspire scholarship @ Rs.18,000/-+30% H.R.A. p.m. in addition to Rs. 20,000/- per annum as contingent grant. 1 Ph.D. student received National Fellowship @ Rs.16,000- P.M. in addition to Rs.10,000/- P.A. as contingency grant.

12 M.Sc. students received ICAR Junior Research Fellowship at the rate of Rs.8640 /- p.m. in addition to Rs. 6000 /- per annum as the contingent grant and 25 M.Sc. students received ICAR-IASRI fellowship at the rate of Rs.7560/- p.m. in addition to Rs. 6000/- per annum as the contingent grant. 3 foreign students have not received the fellowship from the institute.

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 & Bioinformatics were strengthened.

54th Convocation of Post Graduate School IARI

54th Convocation of Post Graduate School IARI was held during 1-5 February 2016. A total of 24 students in the disciplines of Agricultural Statistics, Computer Application and Bioinformatics have been awarded with Ph.D. / M.Sc. degrees. The discipline wise number of students who got degrees are as follows:

- 3 Ph.D and 8 M.Sc. (Agricultural Statistics)
- 8 M.Sc. (Computer Application)
- 5 M.Sc. (Bioinformatics)

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

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

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

Courses taught during the Academic Year 2015 - 16 in Agricultural Statistics

Trimester - I				
Code	Course Title	Credits		Instructors
		L	P	
PGS 504	Basic Statistical Methods in Agriculture	2	1	Susheel Kumar Sarkar, Upendra Kumar Pradhan, AK Gupta

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

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

Trimester - III				
Code	**Course Title (L + P)**	**Credits**		**Instructors**
		L	**P**	
CA 503	Statistical Computing in Agriculture	1	2	Rajender Parsad, Ranjit Kumar Paul, Sukanta Dash
CA 563	Operating System	2	1	N Srinivasa Rao, Sangeeta Ahuja

CA 568	Software Engineering	2	0	AK Choubey
CA 567	Computer Networks	2	1	SN Islam, Mukesh Kumar
CA 571	Modeling and Simulation	2	1	Anshu Bhardwaj, Amrit Kumar Paul
CA 691	Seminar	1	0	Alka Arora

Courses taught during the Academic Year 2015 - 16 in Computer Application

Trimester - I				
Code	**Course Title (L + P)**	**Credits**		**Instructors**
		L	**P**	
CA 502	Introduction to Computer Application	1	1	SN Islam, Samir Farooqi
CA 551	Mathematical Foundations in Computer Application	4	0	Sukanta Dash, Kanchan Sinha
CA 552	Computer Oriented Numerical Methods	2	1	Pal Singh, Upendra Kumar Pradhan
CA 560	Computer Organization and Architecture	3	0	N Srinivasa Rao, Anil Rai
CA 561/ BI 505	Principles of Computer Programming	2	1	SB Lal, KK Chaturvedi
CA 565	Compiler Construction	2	1	Sangeeta Ahuja, AK Mishra
CA 569	Web Technologies and Applications	2	1	Alka Arora
CA 570	Computer Graphics	2	1	Pal Singh
CA 575	Artificial Intelligence	2	1	Rajni Jain
CA 611	Design and Analysis of Algorithms	2	1	Sudeep, Mukesh Kumar
CA 621	Advances in Data Mining	2	1	Anshu Bharadwaj, D.C. Mishra, Sanjeev Kumar
CA 691	Seminar	1	0	N Srinivasa Rao
Trimester - II				
CA 501	Computer Fundamentals and Programming	3	1	Pal Singh, Sangeeta Ahuja
CA 562	Object Oriented Analysis and Design	2	1	Sudeep, N Srinivasa Rao
CA 564	Data Structures and Algorithms	2	1	AR Rao, AK Mishra
CA 566/ BI 507	Data Base Management System	2	2	SB Lal, Mukesh Kumar, Soumen Paul
CA 572	GIS and Remote Sensing Techniques	2	1	Alka Arora, Anshu Bharadwaj, AP Ruhil
CA 577	Data Mining and Soft Computing	2	1	Alka Arora, Anshu Bharadwaj, AP Ruhil
CA 578	Information Security	2	1	Mukesh Kumar ,Sudeep
CA 612	Fuzzy Sets and Rough Sets	2	1	Sudeep, Alka Arora
CA 691	Seminar	1	0	SN Islam

Courses taught during the Academic Year 2014-15 in Bioinformatics

Trimester - III				
Code	**Course Title (L + P)**	**Credits**		**Instructors**
		L	**P**	
BI 502	Protein Structure Analysis	2	1	Anil Rai, Sarika

BI 503	Computational Biology	2	1	AR Rao, DC Mishra
BI 504	Evolutionary Biology	2	1	Sunil Archak, AK Mishra
BI 621	Quantum Theory and Applications in Biology	2	1	Monendra Grover
BI 691	Seminar	1	0	MA Iquebal

Courses taught during the Academic Year 2015-16 in Bioinformatics

Trimester - I				
Code	**Course Title (L + P)**	**Credits**		**Instructors**
		L	**P**	
BI 501/ MBB 509/ GP 540	Introduction to Bioinformatics	2	1	AR Rao, KV Bhatt, Amole Kumar, U. Solanke
BI 505/ CA 561	Principles of Computer Programming	2	1	SB Lal, KK Chaturvedi
BI509/ BIO601	Nucleic Acids	2	1	BIO Faculty
BI 510/ MBB 501	Principles of Biotechnology	4	0	MBB Faculty
BI 511 / BIO 501	Basic Biochemistry	4	1	BIO Facutly
BI 512	Advanced Programming in Bioinformatics	2	2	UB Angadi, SB Lal
BI 601	Genome Assembly and Annotation	1	2	Sanjeev Kumar, DC Mishra
BI 602	Biomolecular Modelling and Simulation	2	1	UB Angadi, M Grover, Anil Rai
BI 622	Molecular Dynamics	2	1	SS Marla, Monendra Grover
BI 613	Parallel Programming and Algorithm Development	2	1	SB Lal, KK Chaturvedi
BI 691	Seminar	1	0	MA Iquebal
Trimester - II				
BI 506	Computational Genomics	3	1	MA Iquabal, DC Misra, Sarika
BI 507 / CA 566	Database Management System	2	2	SB Lal, Mukesh Kumar, Soumen Paul
BI 508	Computer Applications in Bioinformatics	2	1	SB Lal, KK Chaturvedi
BI 603	Machine Learning Techniques in Bioinformatics	2	1	Sanjeev Kumar, MA Iquebal
BI 604	Computational Techniques of Transcriptomics and Metabolomics	1	1	AR Rao, Samir Farooqi
BI 632	Peptide Design, Synthesis and Applications	2	1	Monender Grover, UB Angadi
BI 624	Genome Wide Association Study	2	1	KV Bhat, Sunil Archak, T Napolean
BI 691	Seminar	1	0	Samir Farooqi

Board of Studies for Academic Year 2015-16

Agricultural Statistics

1.	Dr. Seema Jaggi, Professor (Agricultural Statistics)	Chairperson
2.	Dr. UC Sud, Director	Member (Ex-officio)
3.	Dr. Himadri Ghosh, Principal Scientist	Member
4.	Dr. Prachi Misra Sahoo, Senior Scientist	Member
5.	Dr. Eldho Varghese, Scientist	Member Secretary
6.	Sh. Pradip Basak, Student	Students' Representative

Computer Application

1.	Dr. Seema Jaggi, Professor (Computer Application)	Chairperson
2.	Dr. UC Sud, Director	Member (Ex-Officio)
3.	Dr. AK Choubey, Head, (Computer Application)	Member
4.	Dr. Sudeep, Senior Scientist	Member
5.	Dr. SB Lal, Scientist	Member Secretary
6.	Sh. Srikumar Biswas, Student	Students' Representative

Bioinformatics

1.	Dr. Anil Rai, Professor (Bioinformatics)	Chairman
2.	Dr. UC Sud, Director	Member Ex-officio
3.	Dr. KV Bhatt, Principal Scientist	Member
4.	Dr. Kishore Gaikwad, Principal Scientist	Member
5.	Dr. T Napolean, Senior Scientist	Member
6.	Dr. Sanjeev Kumar, Scientist (Sr. Scale)	Member
7.	Dr. KK Chaturvedi, Scientist	Member Secretary
8.	Sh. Amit Kairi, Student	Students' Representative

Central Examination Committee for Academic Year 2015-16

Agricultural Statistics

1.	Dr. UC Sud, Director
2.	Dr. Seema Jaggi, Professor (Agricultural Statistics)
3.	Dr. Anil Rai, Head (CABin)
4.	Shri SD Wahi, Principal Scientist
5.	Dr. Girish Kumar Jha, Principal Scientist
6.	Dr. Cini Varghese, Principal Scientist

Computer Application

1.	Dr. UC Sud, Director
2.	Dr. Seema Jaggi, Professor (Computer Application)
3.	Dr. AK Choubey, Head (Computer Application)
4.	Dr. Alka Arora, Senior Scientist
5.	Dr. Srinivasa Rao, Senior Scientist
6.	Sh. KK Chaturvedi, Scientist

Bioinformatics

1.	Dr. UC Sud, Director
2.	Dr. Anil Rai, Professor (Bioinformatics)
3.	Dr. Rajender Parsad, Principal Scientist
4.	Dr. SS Marla, Principal Scientist
5.	Dr. KK Chaturvedi, Scientist
6.	Dr. M Grover, Senior Scientist

6

AWARDS

Awards

Dr. Hukum Chandra

- Received National Award in Statistics 2014-15 from the Ministry of Statistics and Programme Implementation, Government of India, on June 29, 2015, at Vigyan Bhawan, New Delhi. The award was conferred by General (Dr.) VK Singh, Hon'ble Minister of State, Ministry of Statistics and Programme Implementation, Government of India.

Dr. AR Rao

- Conferred as Fellow, National Academy of Agricultural Sciences, New Delhi under Section "Social Sciences (covering Agricultural Economics, Agricultural Statistics, Extension Education, Food Science & Nutrition, Food Technology, Home Science and Bioinformatics)".
- Awarded as Fellow, Indian Society of Genetics and Plant Breeding, New Delhi by considering achievements and contributions in the field of Crop Improvement.

Dr. Seema Jaggi

- Received the INSA Teachers Award 2015 in the Anniversary General Meeting of the Academy held during December 28-30, 2015 at Indian Institute of Science, Education and Research (IISER), Bhopal.

Dr. Alka Arora

- Received Active participation Award Women Member 2014-15 from Computer Society of India, Delhi Chapter in recognition of significant contribution to the CSI Chapter activities on 05 December 2015.

Dr. Ranjit Kumar Paul

- Received the Yound Scientist Award of the Society for Application of Statistics in Agtriculture and Allied Sciences (SASAA) on March 03, 2016 at National Seminar on Recent Advances in Statistical Tools for Agriculture and Allied Sciences organized by Society for Application of Statistics in Agricultural and Allied Sciences (SASAA) in collaboration with Department of Agricultural Statistics, Bidhan Chadra Krishi Viswavidyalaya (BCKV), Mohanpur and Indian

Institute of Science Education and Research (IISER), Kolkata during 03-05 March 2016

Dr. Arpan Bhowmik

- Received Dr. GR Seth Memorial Young Scientist Award in 69th Annual Conference of Indian Society of Agricultural Statistics at University of Kota, Kota, Rajasthan during December 14-16, 2015 for the following paper:

  Bhowmik, A, Varghese, E, Jaggi, S and Varghese, C (2015). Factorial Experiments with Minimum Changes in Run Sequences.

Dr. Dinesh Kumar

- Awarded Gold Medal with Certificate of Academic Excellence in Graduation Ceremony, on 05 September 2015 for having First Rank in First Batch as ICAR nominated and sponsored candidate in Post Graduate Diploma in Technology Management in Agriculture (PGDTMA), a joint course of ICAR-NAARM and Central University Hyderabad.
- Received the Distinguished Scientist Award of the Society for Bioinformatics and Biological Sciences, Allahabad in recognition of her meritorious and outstanding scientific contribution in the field of Bioinformatics.

Dr. Eldho Varghese and Dr. Arpan Bhowmik

- Received कृषि विज्ञान गौरव (Krishi Vigyan Gaurav) मानद उपाधि (Honorary Title) by भारतीय कृषि अनुसंधान समिति (Bhartiya Krishi Anusandhan Samiti) and कृषि अनुसंधान संचार केन्द्र [Agricultural Research Communication Center (ARCC)] करनाल (Karnal) for carrying out good amount of research work in official language हिंन्दी (Hindi).

Dr. MA Iquebal

- Received the Young Scientist Award and Team Award of the Society for Bioinformatics and Biological Sciences, Allahabad in recognition of his outstanding scientific contribution in the field of Bioinformatics.
- Received the Young Scientist Award of the Society for Application of Statistics in Agriculture and Allied Sciences (SASAA) on March 03, 2016 at National Seminar on Recent Advances in Statistical Tools for Agriculture and Allied Sciences organized by Society for Application of Statistics in Agricultural and Allied Sciences (SASAA) in collaboration with Department of Agricultural Statistics, Bidhan Chadra Krishi Viswavidyalaya (BCKV), Mohanpur and Indian Institute of Science Education and Research (IISER), Kolkata during March 03-05, 2016.

Dr. Sarika

- Received the Distinguished Scientist Award and Team Award of the Society for Bioinformatics and Biological Sciences, Allahabad in recognition of her meritorious and outstanding scientific contribution in the field of Bioinformatics.

Smt. Suman Khanna

- Received ICAR Cash Award/Certificate of Distinction 2014 for Administrative Category on the occasion of ICAR Foundation Day held on 25 July 2015 at Patna.

Best Paper/ Poster Awards

- Panwar, S, Kumar, A, Singh, KN, Gurung, B and Rathore, A (2015). Use of weather indices approach in wheat yield crop forecast. Awarded as Best Paper in the 2nd International Conference on Agriculture, Horticulture and Plant Science held at Shimla during 26-27 December 2015.
- Devi, Lethe and Angadi, UB(2016). FeedAsist an expert system for computing least cost balance at 8th GCRA International Conference

on Innovative Digital Applications for Sustainable Development, University of Agricultural Science, Bengaluru, during 05 -07 January 2016.

- Kumar, G, Tandon, G, Iquebal, MA, Sarika, Kumar, S, Kumar, D, Gireesh-Babu, P and Chaudhari, Aprna (2016). Homology modelling and docking studies on reproductive hormones and receptors of Clarias magur received Best Poster Award (3rd Prize) in the 2nd International Symposium on Genomics in Aquaculture organized by the ICAR-Cantal Institute of Freshwater Aquaculture in collaboration with Association of Aquaculturist and Asian Fisheries Society, Indian Branch during 28-30 January 2016 at Bhubaneswar.

RECOGNITIONS

Dr. UC Sud

- Nominated by DG, ICAR as a member of National Supercomputing Mission Executive Board, Ministry of Science & Technology, Department of Science & Technology, Technology Bhawan, New Delhi.
- Member, Technical Committee under the Chairmanship of DG(NSSO) to look into the details of Integrating the data on Crop Cutting Experiments (CCEs)
- Member, Expert Committee to evolve standards for statistical disclosure control (NSSO)
- नगर राजभाषा कार्यान्वयन समिति उत्तरी दिल्ली का सदस्य नामित किया गया।

Dr. Anil Rai

- Invited as Technical Expert by Tea Board of India for development of methodology for estimation of cost of production of tea in Coimbatore.

Dr. KN Singh

- Chaired the session of working group of Statistical Methodology for Crop Yield Forecasting at University of Agricultural Sciences, Dharwad, Karnataka.

Dr. AK Choubey

- Worked as Coordinator to conduct the classes and examination for PG Diploma in Technology Management in Agricultural (PG-TMA), ICAR-NAARM, Hyderabad during December 07-13, 2015 at ICAR-IASRI, New Delhi.

Dr. Tauqueer Ahmad

- Nominated by Aligarh Muslim University (AMU), Aligarh as a Co-Opted Member of Board of Studies (BOS) of Department of Statistics and Operations Research, AMU, Aligarh.
- Appointed as Eminent Scientist in the Committee for conducting interview for the award of UGC BSR fellowship to Ph.D. Statistics and Operations Research students on December 28, 2015 by the Department of Statistics & Operations Research, AMU, Aligarh.
- Invited speaker in the International Conference on Recent Advances in Mathematics, Statistics and Computer Science organized by the Central University of South Bihar (CUB), Patna held during 29-31 May 2015 at ICAR Research Complex for Eastern Region, Patna.

Dr. Seema Jaggi

- Nominated as member Institute Management Committee, ICAR-IIMR, New Delhi.

Dr. Hukum Chandra

- International Consultant for the Food and Agricultural Organization (FAO) of the United Nations in the project on “Country Statistical Capacity Assessment and Strategic Planning in Agricultural Statistics in Sri Lanka” under Global Strategy to Improve Agricultural and Rural Statistics”, Colombo, Sri Lanka during June 16 to July 03 and September 21 to October 01, 2015.
- Member, sub-group on “development of common curriculum for training on agricultural and rural statistics in Asia and the Pacific”, United Nations Statistical Institute for Asia and the Pacific, Chiba, Japan.
- Member, sub-group on “skills framework and training needs assessment tools for agricultural and rural statistics in Asia and the Pacific”, United Nations Statistical Institute for Asia and the Pacific, Chiba, Japan.
- Expert Member, Small area poverty estimation project, Directorate of Economics & Statistics, Bhubaneswar, Odisha.
- Invited Speaker, the IISA 2015: International Conference hosted by International Indian Statistical Association, Pune, India, December 20-24, 2015.
- Invited Speaker, the 60th International Statistics Institute (ISI) World Statistics Congress 2015, Rio de Janeiro, Brazil, July 26-31, 2015.

- Invited Speaker, the 69th Annual Conference of Indian Society of Agricultural Statistics at University of Kota, Kota, Rajasthan during December 14-16, 2015.
- Invited Speaker, the 9th Statistics Day Celebration, "C.R. Rao Award – 2015 Lecture" by the Ministry of Statistics & Programme Implementation, Govt. of India, New Delhi, June, 29 2015.

Dr. Rajender Parsad

- Nominated as Executive President of Society of Statistics, Computer and Application, New Delhi.
- Panelist in the panel discussion on on 'E-Granth continuity and promotion to cover whole NARES' on February 27, 2016 during National Workshop on "Strengthening and Sustainability of EGranth" during 26-27 February, 2016 at NASC complex, New Delhi.
- Nominated as member Institute Management Committee, ICAR-NBPGR, New Delhi.

Dr. Dinesh Kumar

- Guest of Honour in Inaugural Session of Accelerating genetic gain of agricultural germplasm by computational approach : Global National Training Workshop on "High-throughput Omics Data for mining of important genes/ traits linked to Agricultural Productivity during September 09-12, 2015 at G. B. Pant University of Agriculture & Technology, Pantnagar.
- Invited as Resource Person in Training-cum-Workshop on Biological Data Analysis through Computational Approach organized at CSIR-North East Institute of Science and Technology, Jorhat-785006, Assam, India during December 8-10, 2015.

Dr. Alka Arora

- Technical committee member and co-convener for 3rd 2016 International Conference on Computing for Sustainable Global Development (INDIACOm2016).
- Member Technical Program Committee for the 10th INDIACom-2016; 3rd International Conference on "Computing for Sustainable Global Development", held during 16–18 March 2016 at Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi.

Dr. Sudeep

- Acted as Chairman, of Working Group of IT-Experts for IPv6 Migration in DARE/ICAR. Compiling and auditing of various computing equipment's for all ICAR institutes is under progress.

Dr. Anshu Bharadwaj

- Member Technical Program Committee for the 10th INDIACom-2016; 3rd International Conference on "Computing for Sustainable Global Development", held during 16–18 March 2016 at Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi.

Dr. Mukesh Kumar

- Member Technical Program Committee for the 10th INDIACom-2016; 3rd International Conference on "Computing for Sustainable Global Development", held during 16–18 March 2016 at BharatiVidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi.

Dr. Anil Kumar

- Nominated Guest of Honor in the valedictory function of short course entitled "Good dairy farming practices: Novel initiatives and extension approaches" at ICAR-NDRI, Karnal and also in the Orientation Program at College of Agriculture, Teerthankar Mahavir University, Moradabad.

Dr. MA Iquebal

- Invited as Resource Person in Training-cum-Workshop on Biological Data Analysis through Computational Approach organized at CSIR-North East Institute of Science and Technology, Jorhat-785006, Assam, India during 8-10 December 2015.

Dr. Sarika

- Received Appreciation Letter by Director, ICAR-CIFA, Bhubaneswar for conducting workshop on "Bioinformatics Tools for Fish Genomics" under CABin Network Scheme at ICAR-CIFA, Bhubaneswar.

Dr. KK Chaturvedi

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

Computing and Applications (AJCSA, http://www.ajsca.org).

- Chaired the session "IT Applications" in the 4th Intl. Conference on Reliability, Infocomm Technologies and Optimization (ICRITO' 2015) at Amity University Noida during 2-4 September 2015.
- Member, Program Committee, Fourth International Conference on Reliability Infocomm Technologies and Optimization (ICRITO' 2015) at Amity University, Noida during 2 - 4 September 2015.
- Member, Organizing Committee, International Conference on Quality, Reliability, Infocom Technology and Business Operations held in University of Delhi during 28-30 December 2015.

Md. Samir Farooqi

- Appointed reviewer for the paper submitted to the journal of "Interdisciplinary Sciences: Computational Life Sciences".
- Appointed reviewer for the paper submitted to the Journal of Genetics.

Offices in Professional Societies/ Research Journals

Advancements and Developments in Statistical Science - An International Journal.

Dr. Hukum Chandra	Member, Editorial Board

Aloy Journal of Soft Computing and Applications

Sh. KK Chaturvedi	Member, Reviewers Board

American Research Journal

Dr. Anshu Bharadwaj	Editor/Reviewer

Annals of Agricultural Research

Sh. SN Islam	Member, Editorial Board

Bureau of Indian Standards, New Delhi

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

Computer Society of India, Delhi Chapter

Dr. Alka Arora	Chairperson, Nomination Committee
Dr. Sudeep	Chairperson, Nomination Committee

Current Trends in Technology & Science

Sh. KK Chaturvedi	Member, Editorial Board

Indian Journal of Agricultural Sciences

Dr. Anil Rai	Member, Editorial Board

Indian Journal of Genetics and Plant Breeding

Dr. AR Rao	Member, Editorial Board

Indian Research Journal of Extension Education, Society of Extension Education.

Dr. Anil Kumar	Associate Editor

Indian Society of Agricultural Statistics

Executive till June 2015

Dr. VK Gupta	Vice President Chair Editor, JISAS
Dr. UC Sud	Honorary Associate Editor, JISAS
Dr. Hukum Chandra	Joint Secretary
Dr. Lal Mohan Bhar	Joint Secretary
Dr. Rajender Parsad	Co-ordinating Editor, JISAS
Dr. Sudeep	Member, Executive Council
Dr. Alka Arora	Member, Executive Council
Dr. AK Paul	Member, Executive Council
Dr. SB Lal	Member, Executive Council
Dr. KK Chaturvedi	Member, Executive Council
Dr. Sangeeta Ahuja	Member, Executive Council
Dr. Prawin Arya	Member, Executive Council
Sh. SN Islam	Member, Executive Council
Dr. BN Mandal	Refree, JISAS

Executive w.e.f. July 2015

Sh. SD Wahi	Vice President
Dr. UC Sud	Honorary Secretary Co-ordinating Editor, JISAS

Dr. AK Paul	Joint Secretary
Dr. Susheel Kumar Sarkar	Joint Secretary
Dr. Anil Rai	Co-ordinating Editor, JISAS
Dr. AK Choubey	Co-ordinating Editor, JISAS
Dr. Ranjit Kumar Paul	Member, Executive Council
Dr. RK Paul	Member, Executive Council
Sh. Sudhir Srivastava	Member, Executive Council
Dr. MA Iquebal	Member, Executive Council
Dr. Sukanta Dash	Member, Executive Council
Dr. Ankur Viswas	Member, Executive Council
Dr. Sarika	Member, Executive Council
Dr. Anshu Bharadwaj	Member, Executive Council
Md. Sameer Farooqi	Member, Executive Council
Dr. Kaustav Aditya	Member, Executive Council

Indian Society of Agroforestry, Jhansi

Dr. Ajit	Vice President

Indian Journal of Agroforestry

Dr. Ajit	Member, Editorial Board

Indra Gandhi National Open University, New Delhi

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

Institute of Applied Statistics and Development Studies, Lucknow

Dr. VK Gupta	President, Governing Body
Dr. UC Sud	Member, Governing Body
Dr. Rajender Parsad	Member, Governing Body

International Association of Survey Stasticians

Dr. Hukum Chandra	Member, Executive Council

International Journal of Agricultural and Statistical Science

Dr. Anil Kumar	Member, Editorial Board

International Journal of Advanced Research in Computer and Communication Engineering

Dr. KK Chaturvedi	Member, Editorial Board

International Journal of Advancements and Developments in Statistical Science

Dr. Hukum Chandra	Member, Editorial Board

International Journal of Computational and Theoretical Statistics

Dr. VK Gupta	Associate Editor

International Journal of Computational Biology

Dr. AR Rao	Member, Editorial Board

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

Dr. KK Chaturvedi	Member, Editorial Board

International Journal of Emerging Technology and Advanced Engineering

Dr. KK Chaturvedi	Member, Editorial Board

International Journal of Essential Sciences

Dr. Anil Kumar	Member, Editorial Board

International Journal of Genetics and Genomics

Dr. MA Iquebal	Member, Editorial Board

Journal of Agrisearch for Society of Upliftment of Rural Economy, Varanasi

Dr. Sangeeta Ahuja	Associate Editor

Journal of Computer Science and Engineering

Dr. KK Chaturvedi	Member, Editorial Board

Journal of Farming Systems Research and Development Association

Dr. Anil Kumar	Joint secretary and Member, Editorial Board
Dr. Prawin Arya	Member, Editorial Board

Journal of Food Legumes

Dr. MA Iquebal	Subject Editor

Journal of Model Assisted Statistics and Applications

Dr. Hukum Chandra	Member, Editorial Board
Dr. Eldho Varghese	Associate Editor

Journal of Society for Advancement of Wheat Research

Dr. Rajender Parsad	Member, Editorial Board

Journal Progressive Research: An International Journal

Dr. Sukanta Dash	Member, Editorial Board

National Academy of Agricultural Science

Dr. VK Gupta	Editor

Online Journal of Bioinformatics

Dr. MA Iquebal	Member, Scientific Board

Open Access Journal for Medicinal and Aromatic Plants (OAJMAP)

Dr. N Srinivasa Rao	Associate Editor

Prograssive Research in the Society for Scientific Development in Agriculture and Technology

Dr. Anil Kumar	Member, Editorial Board

Rani Laxmi Bai Central Agriculture University, Jhansi

Dr. Ajit	Faculty Member

Society for Application of Statistics in Agriculture and Allied Science (SASAA)

Sh. Soumen Pal	Member, Editorial Board of the Journal (RASHI)

Society for Community Mobilization for Sustainable Development

Dr. Anil Kumar	Member, Editorial Board

Society of Statistics, Computer and Applications

Dr. VK Gupta	President
Dr. Rajender Parsad	Executive President, Executive Editor, Statistics and Application
Dr. LM Bhar	Joint Secretary
Dr. Hukum Chandra	Member, Executive Council and Associate Editor, Statistics and Application
Dr. Seema Jaggi	Member, Executive Council
Dr. Alka Arora	Member, Executive Council
Dr. Anshu Bhardwaj	Member, Executive Council
Dr. BN Mandal	Member, Executive Council

ICAR-IASRI NEWS

Volume 20 No. 4 January-March, 2016

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

From Director's Desk . . .

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

A netting factor of 12.5 per cent is being used to account for seed, feed, and wastages ratios to the food grains production in the country since 1960's. These old norms require re-examination of the basis for this conventional figure. These estimates of wastage ratios for seed, feed and total production in respect of major food grains viz. paddy, wheat, maize, bajra, jowar, ragi and barley has been relooked and recomputed. It indicates that over-all ratios have gone down by 4.5% approximately as compared to the ratios (12.5%) used since long for estimating the total availability of food grains for human consumption in the country. These developed ratios are of immense use for planning and formulation of future policies by the Government and policy makers for the economic development of the country.

An open access web solution named webFMC (http://webfmc.iasri.res.in.) has been developed to generate any combination of symmetric and asymmetric factorial design with minimally changed run sequences. An online catalogue of such run sequences has also been developed and integrated with webFMC.

First whole genome putative microsatellite DNA marker database http://webapp.cabgrid.res.in/sbmdb/) of sugarbeet for bioenergy and industrial applications has been developed and was listed as one of the Salient Achievement for the year 2015 of Indian Council of Agricultural Research (Department of Agricultural Research and Education) by Secretary, DARE & DG, ICAR. (http://www.icar.org.in/files/salient-achievements-2015-DG.pdf)

Five training programmes, three national and two under Centre of Advanced Faculty Training (CAFT) were organized. Besides, two national workshops and one Hindi workshop have also been organized.

Scientists of the Institute have received various awards & recognitions. During the period, four new projects were initiated. Scientists of the Institute have published 29 research papers, 4 book chapters, 25 popular article, 2 training manuals, 6 technical reports, 2 papers in Conference proceedings. Besides, 29 invited lectures were delivered by the scientists. Further, scientists have participated in different conferences/symposia/ workshops, etc.

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

(UC Sud)

ICAR-IASRI ANNUAL REPORT 2014-15

ICAR-INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE
LIBRARY AVENUE, PUSA, NEW DELHI - 110012
www.iasri.res.in
ISO 9001:2008 Certified

कृषि अनुसंधान डाटा पुस्तिका

AGRICULTURAL RESEARCH
DATA BOOK
2015

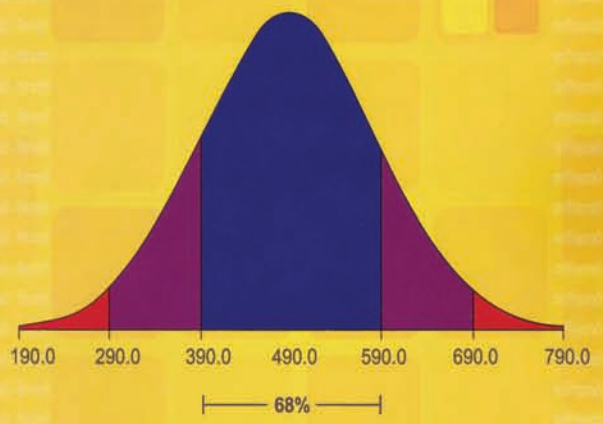
भारतीय कृषि अनुसंधान परिषद्
कृषि भवन, नई दिल्ली-110 001
Indian Council of Agricultural Research
Krishi Bhawan, New Delhi - 110 001

भाकृअनुप-भारतीय कृषि सांख्यिकी अनुसंधान संस्थान
लाइब्रेरी एवेन्यू, पूसा, नई दिल्ली-110 012
ICAR-Indian Agricultural Statistics Research Institute
Library Avenue, Pusa, New Delhi - 110012

अंक 11

2015-16

सांख्यिकी-विमर्श



प्रसामान्य वक्र

भा.कृ.अनु.प.-भारतीय कृषि सांख्यिकी अनुसंधान संस्थान
लाइब्रेरी एवेन्यू, पूसा, नई दिल्ली-110 012

Linkages and Collaborations in India and Abroad including Outside Funded Projects

S.No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
		International Project		
1.	Mapping and cultural authority of science across Europe and India (MACAS-EU & India)	IHD, New Delhi LSE, London, UK	01 April 2012 (ICAR-IASRI association w.e.f. 18 July 2013)	30 September 2015
2.	Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping.	Funding agency: Food and Agriculture Organization of the United Nations (FAO) Rome Collaborative agencies: 1. Statistics Indonesia (BPS), Indonesia 2. National Institute of Statistic of Rwanda (NISR), Rwanda 3. FAO, Kingston, Jamaica 4. Ministry of Agriculture and Fisheries, Govt. of Jamaica 5. FAO, Jakarta, Indonesia 6. FAO, Kigali, Rwanda 7. FAO, Barbados, West Indies.	18 December 2014	17 October 2016
		ICAR Institutes/ SAUs		
3.	Phenomics of moisture deficit and low temperature stress tolerance in rice	ICAR-NRCPB, New Delhi ICAR-IARI, New Delhi Delhi University, New Delhi ICAR-CRRI, Cuttack; ICAR-IGKV, Raipur CAU, Barapani ICAR-RC-NEHR, Barapani	15 February 2011	30 December 2015
4.	Strengthening and refinement of Maize AgriDaksh	ICAR-DMR, New Delhi	01 April 2011	31 March 2016
5.	Planning, designing and analysis of experiments planned 'On Stations' under the AICRP on IFS	ICAR-IIFSR, Modipuram	01 April 2012	31 March 2017
6.	Planning, designing and analysis of 'On Farm' research experiments planned for AICRP on IFS	ICAR-IIFSR, Modipuram	01 April 2012	31 March 2017

S.No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
7.	Planning, designing and analysis of data relating to experiments for AICRP on long-term fertilizer experiments	AICRP on LTFE ICAR-IISS, Bhopal	01 April 2012	31 March 2017
8.	Modelling network of gene responses to abiotic stress in rice	ICAR-NRCB, New Delhi, ICAR-DRR, Hyderabad, ICAR-DKMA, New Delhi, CDAC, Pune (NFBSFARA)	01 April 2013	31 March 2017
9.	Information system for planning and analysis of experiments on All-India Coordinated Research Project on Vegetable Crops	AICRP, ICAR-IIVR, Varanasi ICAR-NAARM, Hyderabad	05 February 2014	31 March 2017
10.	Development of innovative approaches for small area estimation of crop yield, socio-economic and food insecurity parameters	ICAR, Lal Bahadur Shastri Young Scientist Award	09 December 2013	08 December 2016
11.	Network project on market intelligence	ICAR-NIAP, New Delhi (ICAR, DARE)	13 February 2014	31 March 2017
12.	Development of 16s rDNA rumen specific microb database	ICAR-NIANP, Bangalore	01 April 2014 (IASRI association w.e.f. 23 July 2014)	31 March 2017
13.	Development and application of electronic learning and diagnostic modules for health management of dogs	ICAR-IVRI, Izatnagar	01 July 2014	31 December 2015
14.	Tobacco Agridaksh: An online expert system	ICAR-CTRI, Rajahmundry	20 October 2014	20 October 2017
15.	Network project on impact assessment of agricultural research and development	ICAR-NIAP, New Delhi (ICAR)	01 January 2015 (IASRI association w.e.f. 12 January 2015)	31 March 2017
16.	ICAR network project on transgenics in crops	ICAR-NRCPB, New Delhi	27 January 2015	31 March 2017
17.	Developing a comprehensive web based system for agriculturally important microbes	ICAR-NBAIM, Mau	01 April 2015	31 March 2017
18.	Computational identification and modelling of genetic variation in relation to performance traits in buffaloes	ICAR-CIRB, Hisar	06 June 2015	31 March 2017
19.	Genomic data analysis for identification of economically important markers and viral diagnostics in pulses	ICAR-IIPR, Kanpur	06 June 2015	31 March 2017
20.	Computational approach for harnessing genome information and its integration with wheat phenome for efficient varietal development	ICAR-IIWBR, Karnal	15 June 2015	31 March 2017
21.	Mining and validation of candidate gene markers and screening on antimicrobial peptides of black pepper and small cardamom	ICAR-IISR, Kozhikode, Kerala	15 June 2015	31 March 2017
22.	Bioinformatic analysis of sequence data of brinjal and bitter gourd for identification of functional and regulatory genes for traits of economic importance	ICAR-NBPGR, New Delhi	16 June 2015	31 March 2017
23.	Molecular and computational approach to delineate metabolic pathways for better carbohydrate utilization in Labeo spp	ICAR-CIFA, Bhubaneshwar	16 June 2015	31 March 2017
24.	Elucidating the mechanism of Pashmina fibre development: An OMICS approach	SKUAST-K, ICAR-NDRI, Karnal	01 July 2015	30 June 2018
25.	Microbial domain research projects on computational aspects	NBAIM, Mau	03 July 2015	31 March 2017
26.	Development of database repertoire for Clostridium perfiringens strains prevalent in causing Enterotoxaemia in goats	ICAR-CIRG, Makhdoom	04 July 2015	31 March 2017

S.No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
27.	Development of database on SNPs associated with economically important traits of Indian goats	ICAR-CIRG, Makhdoom	04 July 2015	31 March 2017
28.	RiceMetaSys: Understanding rice gene network for blast resistance and drought tolerance through system biology approach	ICAR-NRCPB, New Delhi	08 July 2015	31 March 2017
29.	ICAR Research Data Repository for Knowledge Management as KRISHI: Knowledge based Resources Information System Hub for Innovations in Agriculture. Funded by ICAR Headquarter Plan Scheme under XII Plan period (2012-2017)	ICAR-NAARM, Hyderabad, ICAR-NBSS&LUP, Nagpur, ICAR-IARI, New Delhi, DKMA, New Delhi, ICAR-CMFRI, Kochi, ICAR-CRIDA, Hyderabad	24 July 2015	31 March 2017
30.	Identification of genetic polymorphisms for pathogenicity in Vibrio sp	ICAR-CIBA, Chennai	19 August 2015	31 March 2017
31.	Metagenomic applications and transcriptomes profiling for inland aquatic environmental health surveillance	ICAR-CIFRI, Barrackpore	01 September 2015	31 March 2017
32.	Cluster ensemble algorithms for germplasms evaluation on Chickpea	ICAR-NCIPM, New Delhi, ICAR-NBPGR, New Delhi	18 September 2015	17 September 2016
33.	Network project on computational biology and agricultural bioinformatics under two sub-projects: Sub-project 1: Gene regulatory networks modeling for heat stress responses of sources and sink for development of climate smart wheat Sub-project 2: Studying drought-responsive genes in subtropical maize germplasm and their utility in development of tolerant maize hybrids	ICAR-IARI, New Delhi	26 November 2015	31 March 2017
34.	Transcriptome and proteome analysis for identification of candidate genes responsible for pistillate nature in castor. Funded by Extramural funded under Crop Sciences Division	ICAR- IIOR, Hyderabad	21 January 2016	31 March 2017
35.	Knowledge management system for agriculture extension services in Indian NARES. Funded by Extramural funded under Agricultural Extension Division, ICAR	Agricultural Extension Division, ICAR	04 March 2016	31 March 2017
		Government of India		
36.	Experimental designs in the presence of indirect effects of treatments	DST	01 October 2011	30 September 2015
37.	A new distributed computing framework for data mining	BITS, Pilani (Department of Electronics & Information Technology, Government of India)	15 October 2012 (IASRI association w.e.f. 01 November 2012)	31 March 2016
38.	Pilot study for estimation of seed, feed and wastage ratios of major food grains	National Accounts Division, Central Statistics Office, MOS&PI, Government of India	01 July 2013	31 March 2016
39.	Bioacoustics tool: A novel non-invasive approach for different monitoring of health and productivity in dairy animals	ICAR-NDRI, Karnal (DBT)	01 February 2013	31 January 2016
40.	Whole genome sequencing and development of allied genomics resources in two commercially important Fish-*Labeo rohita* and *Clarias batrachus*	ICAR-NBFGR, CIFA, AAU (DBT)	28 January 2014	09 September 2016

S.No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
41.	Whole genome based SNP mining and development of breed signatures for dairy and dual purpose indigenous cattle	ICAR-NBAGR, Karnal ICAR-NDRI, Karnal (DBT)	09 July 2014	08 July 2017
42.	Study to test the developed alternative methodology for estimation of area and production of horticultural crops: IASRI component of CHAMAN program under MIDH	Funding agecncy: Departmen of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare (MoA&FW), Government of India. Collaborative agencies: ➢ Mahalanobis National Crop Forecast Centre (MNCFC,) MoA&FW, Govt. of India, Pusa Campus, New Delhi ➢ Gujrat State Govt. ➢ Himachal Pradesh State Govt. ➢ Andhra Pradesh State Govt. ➢ Karnataka State Govt. ➢ Tamil Nadu State Govt. ➢ Maharashtra State Govt.	16 September 2014	15 June 2017
43.	Pilot study for developing state level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanthan Committee Report	Directorate of Economics and Statistics, Department of Agriculture Cooperation Farmers Welfare, Ministry of Agriculture Farmers Welfare, Government of India, New Delhi	16 February 2015	15 February 2017
44.	Investigation of causes of divergence between official and trade estimates of jute production	Directorate of Economics & Statistics (DES), Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India	01 September 2015	31 August 2017
45.	Stochastic differential equation models and their applications to agriculture	Science and Engineering Research Board (SERB), New Delhi	06 November 2015	05 November 2018
		Consultancy Studies		
46.	Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping	Food and Agriculture Organization of the United Nations (FAO)), Rome.	18 December 2014	17 October 2016
47.	Testing and validation of alternative methodology developed by ICAR-IASRI for estimation of area and production of horticultural crops in Madhya Pradesh State	DAC & FW MoA & FW, Govt. of India Madhya Pradesh State Govt.	01 June 2015	28 February 2018
48.	Testing and validation of alternative methodology developed by ICAR-IASRI for estimation of area and production of horticultural crops in Haryana State	DAC & FW, MoA & FW, Govt. of India haryana State Govt.	06 August 2015	05 May 2018
49.	Development of software for data entry and undertaking, analysis of data for storage losses in FCI/CWC godowns	AICRP on Post Harvest Technology, ICAR-CIPHET, Ludhiana	15 October 2015	31 March 2016

8

List of Publications

Research Papers

1. Ahmad, T, Bathla, HVL, Rai, A and Sahoo, PM (2015). Estimation of area and production of horticultural crops in Himachal Pradesh. *Adv. Appl. Res.,* **7(1)**, 1-8.
2. Ahmad, T, Sahoo, PM and Jally, SK (2015). Estimation of area under agroforestry using high resolution satellite data. *Agroforest. Sys.*, **90(2)**, 289-303.
3. Ahmad, T, Sahoo, PM and Jally, SK (2015). Agroforestry area estimation using remote sensing technique in Vaishali District of Bihar State. *Int. J. Agril. Statist. Sci.*, **11(1)**, 269-274.
4. Anjum, A, Jaggi, S, Varghese, E, Lall, S, Bhowmik, A and Rai, A (2015). Identification of differentially expressed genes in RNA-seq data of arabidopsis thaliana: A compound distribution approach. *J. Comput. Bio.*, **23(4)**, 239-247.
5. Anshida, Beevi, CN, Wason, Padaria, RN, Kumbhare, NV and Varghese, E (2015). socio-psychological drivers of livelihood diversification in Lakshadweep. *Ind. J. Extn. Edu.*, **51(3&4)**, 34-39.
6. Arya, P, Paul, RK, Kumar, A, Singh, KN, Sivaramne, N and Chaudhary, P (2015). Predicting pest population using weather variables: An ARIMAX time series framework. *Int. J. Agril. Statist. Sci.*, **11(2)**, 381-386.
7. Balakrishnan, R, Wason, M, Padaria, RN, Singh, P and Varghese, E (2014). An Analysis of constraints in e-learning and strategies for promoting e-learning among farmers. *Econ. Affairs*, **59**, 727-734.
8. Banerjee, V, Das, B, Krishnan, P, Verma, APS and Varghese, E (2015). Crop Status Index as an indicator of wheat crop growth condition under abiotic stress situations. *Field Crops Res.*, **181**, 16-31.
9. Bardhan, SR, Rao, AR, Meher, PK, Marwaha, S, Wahi, SD (2015). Identification of a suitable clustering method and allocation strategy for core set development in salt stress tolerant rice (*Oryza sativa*) germplasm. *Ind. J. Agril. Sci., **85(12)***, 1560-1564.
10. Basak, P, Chandra, H, Sud, UC and Lal, SB (2015). Prediction of population total for skewed variable under a log transform model. *Int. J. Agri. Stat. Sci.*, **9(1)**, 143-154.
11. Behera, BK, Baisvar, VS, Kumari, K, Rout, AK, Pakrashi, S, Paria, P, Rao, AR and Rai. A (2015). The complete mitochondrial genome of the Anabas testudineus (Perciformes, Anabantidae) and its comparison with other related fish species. *Mitochondrial DNA*, DOI: 10.3109/19401736.2015.1115490.
12. Behera, BK, Das, P, Maharana, J, Meena, DK, Sahu, TK, Rao, AR, Chatterjee, S, Mohanty, BP, Sharma, AP (2015). Functional Screening and molecular characterization of halophilic and halotolerant bacteria by 16S rRNA gene sequence analysis. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences*, **85(4)**, 957-964.
13. Bhardwaj, SP, Paul, R and Kumar, A (2015). Future trading in soybean-An econometric analysis. *J. Ind. Soc. Agril. Statist.*, **69(1),** 11-17.
14. Bhardwaj, SP, Paul, RK and Singh, KN (2015). Price forecast an instrument for improvement

in agricultural production and marketing in Rajasthan- A case study of rape seed and mustard seeds. *Ind. J. Agril. Marketing,* **29(2)**, 163-171.

15. Bhati, J, Chaduvula, PK, Kumar, S, Marla, SS and Rai, A (2016). In-silico prediction and functional analysis of salt stress responsive genes in Rice (Oryza sativa). *J. Rice Res.*, **4**, 164. DOI:10.4172/2375-4338.1000164
16. Bhatia, K, Asrey, R and Varghese, E (2015). Correct packaging retained phytochemical, antioxidant properties and increases shelf life of minimally processed pomegranate (*Punica granatum L.*) arils Cv. Mridula. *J. Sci. Industrial Res.,* **74**,141-144.
17. Bhowmik, A, Jaggi, S, Varghese, C and Varghese, E (2015). Optimal block designs with interference effects from neighbouring units under a non-additive model. *Comm. Statist-Theory. Methods,* **44(10),** 2092-2103.
18. Bhowmik, A, Jaggi, S, Varghese, C and Varghese, E (2015). Trend free block designs balanced for interference effects from neighbouring experimental units. *J. Comb., Inform. and Sys. Sci.*, **39 (1-4)**, 117-133.
19. Bhowmik, A, Jaggi, S, Varghese, C and Varghese, E (2015). Trend free second order neighbour balanced block designs. *J. Ind. Statist. Asso.,* **53(1 & 2)**, 63-78.
20. भौमिक, अर्पण, वर्गीस, एल्दो, जग्गी, सीमा, वर्गीस, सिनी, गहलौत, बी.जे. एवं बिन्दल, विजय (2015). उपचारों के प्रभाव के सही आकलन हेतु उच्च क्रम नेबर सन्तुलित चक्रीय ब्लॉक अभिकल्पनाऐं, भारतीय कृषि अनुसंधान पत्रिका, **30(3),** 155-158.
21. Biswas, A, Rai, A, Ahmad, T and Sahoo, PM (2015). Spatial estimation approach under ranked set sampling from spatial correlated finite population. *Int. J. Agril. Statist. Sci.*, **11(2)**, 551-558.
22. Biswas, A, Rai, A, Ahmad, T and Sahoo, PM (2016). Spatial estimation and rescaled spatial bootstrap approach for finite population. *Comm. in Statist. - Theory and Methods* (DOI: 10.1080/03610926.2014.995820).
23. Chaduvula, PK, Bhati, J, Rai, A, Gaikwad, K, Marla, SS, Elangovan, M and Kumar, S (2015). Insilico expressed sequence tag analysis in identification and characterization of salinity stress responsible genes in Sorghum bicolour. *Aust. J. Crop Sci.*, **9(9)**, 799-806.
24. Chandra, H and Chambers, R (2016). small area estimation for semicontinuous Data. *Biom. J.*, **58(2)**, 303-319.
25. Chandra, H, Salvati, N and Chambers, R (2015). A Spatially nonstationary Fay-Herriot model for small area estimation. *J. Surv. Statist. Method.*, **3(2)**, 109-135.
26. Chandrika, KSV P, Singh, A , Rathore, A and Kumar, A (2016). Novel cross linked guar gum-g-poly(acrylate) porous superabsorbent hydrogels: Characterization and swelling behaviour in different environments. *Carbohydrate Polymers*, **149**, 175-185.
27. Chaturvedi, V, Kumar, A, Mishra, IM, Singh, JK, Sahoo, RN, Jha, GK and Lal, SB (2016). Study on interventions to reduce vibration transmission to power tiller operator. *J. Appl. Natural Sci.*, **8(1)**, 265 - 272.
28. Choudhary, RK, Rao, AR, Wahi, SD and Misra, AK (2016). Detection of biennial rhythm and estimation of repeatability in mango (Mangifera indica L.). *Ind. J. Genet. Plant Breed.*, **76(1)**, 88-97.
29. Das, S, Bit, A, Patnaik, S, Sahoo, L, Meher, P, Saha, T. Patel, A, Patel, N, Koringa, Joshi, C, Agarwal, S, Pandey, M, Srivastava, S, Kushwaha, B, Kumar, R, Nagpure, N, Iquebal, MA, Jaiswal, S, Kumar, D, Jayasankar, P, Jena, J and Das, P (2015). Low depth shotgun sequencing resolves complete mitochondrial genome sequence of Labeo rohita. *Mitochondrial DNA* (http://www.tandfonline.com/doi/full/10.3109/19401736.2015.1074197)
30. Das, S, Pandey, P, Rai, A and Mohapatra, C (2015). A computational systems biology approach to construct gene regulatory networks for salinity response in rice (*Oryza sativa*). *Ind. J. Agril. Sci.*, **85(12),** 1546–1552.
31. Dasyam, R, Bhattacharyya, B and Pal, S (2015). Trend estimation by parametric and nonparametric modeling for area, production and yield of rice in West Bengal. *The Ecoscan*, **9(1 & 2)**, 451-455.
32. Dasyam, R, Pal, Soumen, Rao, VS and Bhattacharyya. B (2015). Time series modeling for trend analysis and forecasting wheat production of India. *Int. J. Agril. Env. Biotech*., **8(2)**, 303-308.
33. Datta, A, Jaggi, S, Varghese, C and Varghese, E (2015). Some series of row-column designs with multiple units per cell. *Cal. Statist. Asso. Bull.*, **67 (265-266)**, 89-99.

34. Devi, CP, Munshi, AD, Behera, TK, Choudhary, H, Vinod, Gurung, B, Saha, P (2015). Cross compatibility study in interspecific hybridization of Solanum melongena and its wild relatives. *Scientia Horticulturae*, **193**, 353-358.

35. Divya, B, Robin, S, Biswas, A and John, JA (2015). Genetics of association among yield and blast resistance traits in Rice (Oryza sativa L). *Ind. J. Agril. Sci.*, **85(3)**, 354-360.

36. Ganeshan, P, Jain, A, Parmar, B, Rao, AR, Sreenu, K, Mishra, P, Mesapogu, S, Subrahmanyam, D, Ram, T, Sarla, N and Rai, V (2016). Identification of salt tolerant rice lines among interspecific BILs developed by crossing Oryza sativa × O. rufipogon and O. sativa × O. nivara. *Aust. J. Crop Sci.,* **10(2)**, 220-228.

37. Ghosh, H, Prajneshu and Samanta, S (2015). Fitting of self-exciting threshold autoregressive moving average nonlinear time-series model through genetic algorithm and development of out-of-sample forecasts. *Statist.,* **48**,1166-1184.

38. Ghosh, H, Chowdhury, S, and Prajneshu (2015). An improved fuzzy time series method of forecasting based on L-R fuzzy sets and its application. *J. Appl. Statist*. DOI:10.1080/02664763.2015.1092111.

39. Ghosh, H, Gurung, B and Prajneshu (2015) Fitting EXPAR models through the extended Kalman filter. *Sankhya*, **77-B**, 27-44.

40. Grover, M and Mishra, DC (2015). Development of computational methods for classification and determination of function in proteins related to abiotic stress in Poaceae. *J. Appl. Bio. Sci. Res.*, **12**, 1-3.

41. Grover, M, Kumar, S, Kumar, R and Mishra, DC (2015). What does it mean to gain complete understanding of biological systems. *J. Appl. Bio. Sci. Res.,* **12**, 4-5.

42. Gupta, A, Amrapali, S, Kumar, M, Khati, P, Lal, B, Agrawal, PK, Mahajan, V and Bhatt, JC (2016). Distinctness, uniformity and stability testing in maize inbreds. *Natl. Acad. Sci. Lett*. **39(1)**, 5-9.

43. Gupta, S, Jadaun, A, Kumar, H, Raj, U, Varadwaj, PK and Rao, AR (2015). Exploration of new drug like inhibitors for serine/threonine protein phosphatase 5 of Plasmodium falciparum: A docking and simulation study. *J. Biomole. Struct. and Dynam.*, **33(11)**, 2421-2441.

44. Gupta, S, Rao, AR, Varadwaj, P, De, S and Mohapatra, T (2015). Extrapolation of inter domain communications and substrate binding cavity of Camel HSP70 1A: A molecular modeling and dynamics simulation study. *PLOS ONE, **10(8)**: e0136630. DOI:10.1371/journal.pone.0136630.*

45. Gurung, B, Singh, KN, Paul, RK, Arya, P, Panwar, S, Paul, AK and Lama, A (2015). Fitting stochastic volatility model through genetic algorithm. *Int. J. Agril. Statist. Sci.,* **11,** 257-264.

46. Gurung, B, Singh, KN, Paul, RK, Panwar, S, Gurung, B and Lepcha, L (2015). An alternative method for forecasting price volatility by combining models. *Comm. in Statist. - Simul. and Comput.*, DOI:10.1080/03610918.2015.1124115.

47. Gurung, B (2015). An Exponential Autoregressive (EXPAR) model for the forecasting of all India annual rainfall. *Mausam*, **66(4)**, 847-849.

48. Gurung, B, Singh, KN, Paul, RK, Arya, P, Panwar, S, Paul, A, Gurung, SR and Lama, A (2015). Fitting stochastic volatility model through genetic algorithm. *Int. J. Agril. Statist. Sci.,* **11(1)**, 257-264.

49. Iquebal, MA, Sarika, Angadi, UB, Sablok, G, Arora, V, Kumar, S, Rai, A and Kumar, D (2015). SBMDb: First whole genome microsatellite DNA marker database of sugar beet for bioenergy and industrial applications. *Database J. Biol. Databases Curation*. DOI: 10.1093/database/bav111.

50. Jaggi, S, Varghese, C and Varghese, E (2016). A series of generalized incomplete Trojan-type designs. *J. Comb. Inform. and Syst. Scie*., **40(1-4)**, 53-60.

51. Jaiswal, S, Dhanda, SK, Iquebal, MA, Arora, V, Shah, TM, Angadi, UB, Joshi, CG, Rahgava, GPS, Rai, Anil and Kumar, D (2016). BIS-CATTLE: A Web server for breed identification using microsatellite DNA markers. *Amer. J. Bioinfor*., http://thescipub.com/abstract/10.3844/ofsp.10407.

52. Jerome, A, Pandey, AK, and Sarkar, SK (2015). Homology modeling of single nucleotide polymorphisms in candidate genes controlling embryonic growth of buffalo. *Ind. J. Anim. Sci.*, **85(6)**, 578–583.

53. Johar, V, Dhillon, RS, Ajit and Handa, AK (2015). Phenological behaviour and reproductive biology of Melia Composita. *Ind. J. Agroforestory*, 1**7(1)**, 62-67.

54. Joshi, D, Singh, HP, and Gurung, B (2015). Stability analysis of Indian spices export – A markov chain approach. *Econ. Affairs*. **60(2),** 257-262.

55. Joshi, MA, Aggarwal, D, Pandey, A, Bind, D and Alam, W (2015). Generation of distinct profiles of rice varieties based on agro-morphological characters and assessment of genetic divergence. *Res. Crops*, **16(2),** 311-319.

56. Kale, SJ, Jha, SK, Jha, GK, Sinha, JP and Lal, SB (2015). Soaking induced changes in chemical composition, glycemic index and starch characteristics of basmati rice. *Rice Sci.,* **22(4)**:*DOI: 10.1016/S1672-6308(14)60296-1.*

57. Karak, T, Kutu, FR, Nath, JR, Sonar, R, Paul, RK, Boruah, RK, Sanyal, S, Sabhapondit, S and Dutta, AK (2015). Micronutrients (B, Co, Cu, Fe, Mn, Mo and Zn) content in made tea (Camellia sinensis L.) and tea infusion with health prospect: A critical review. *Critical Rev. Food Sci. Nutrit.*, DOI: 10.1080/10408398.2015.1083534.

58. Karak, T, Paul, RK, Das, S, Das, DK, Dutta, AK and Boruah, RK (2015). Fate of cadmium at the soil-solution interface: a thermodynamic study as influenced by varying pH at South 24 Parganas, West Bengal, India. *Environ. Monitor. and Asses.*, **187(11)**, 1-18.

59. Karak, T, Paul, RK, Sonar, I, Nath, JR, Boruah, RK and Dutta, AK (2015). Nickel dynamics influenced by Municipal solid waste compost application in tea (Camellia sinensis L.)-A cup that cheers. *Int. J. Environ. Sci. Tech.,* **13(2)**, 663-678.

60. Karak, T, Sonar, I, Nath, JR, Paul, RK, Das, S, Boruah, RK, Dutta, AK and Das, K (2015). Struvite for composting of agricultural wastes with termite mound: Utilizing the unutilized. *Bioresource Tech.,* **187**, 49-59.

61. Kaur, C, Rudra, SG, Saha, S, Varghese, E, Nagal, E (2016). Increasing anthocyanin content in black carrot juice by an enzyme assisted process: Optimization using response surface methodology. *Nutrafoods*, **15**, 59-67.

62. Khandelwal, A, Gupta, S, Gajbhiye, VT and Varghese, E (2015). Degradation of Kresoxim-methyl in water: Impact of varying pH, temperature, light and atmospheric CO_2 level. *Bull. of Environ. Contamin. and Toxicol*. DOI 10.1007/s00128-015-1627-0

63. Koltes, JE, Kumar, D, Kataria, RS, Cooper, V, and Reecy. JM (2015). Transcriptional profiling of PRKG2-null growth plate identifies putative down-stream targets of PRKG2. *BMC Res. Notes*, **8(1)**, 177. DOI: 10.1186/s13104-015-1136-6.

64. Kota, S, Singh, SS, Singh, AM, Mohapatra, T, Ahlawat, AK, Brajendra, P and Mandal, BN (2015). The variation and stability analysis of starch pasting properties among New Plant Type (NPT) Wheat derivatives. *J. Agri. Sci. Tech*., **17**, 1887-1902.

65. Kumar, A, Varghese, C, Varghese, E and Jaggi, S (2015). Irregular Sudoku-type designs for animal experiments. *Ind. J. Anim. Sci.*, **85(9)**, 1046-1050.

66. Kumar, D and Mohammad, SF (2015). On Generalized Order Statistics from Marshall-Olkin Log-Logistic distribution. *Global J. Pure Appl. Maths*., **11(5)**, 3513-3528.

67. Kumar, M, Dubey, AK, Dubey, UC and Ahmad, T (2016). Quantification of agricultural mechanization for soybean -wheat cropping pattern in Bhopal region of India. *Agric. Mechanization Asia, Africa, Latin America*, **47(1),** 28-32.

68. Kumar, M, Sarangi, A, Singh, DK, Rao, AR and Sudhishri, S (2016). Response of wheat cultivars to foliar potassium fertilization under irrigated saline environment. *J. Appl. Natural Sci.,* **8(1)**, 429-436.

69. Kumar, R, Bhowmik, A, Chakdar, ,H, Elumalai, S and Pabbi, S (2015). Biochemical characterization and diversity analysis of cyanobacteria isolated from different locations. *Vegetos*, **28(1**), 38-48.

70. Kumar, RR, Goswami, S, Sharma, SK, Kala, YK, Rai, GK, Mishra, DC, Grover, M, Singh, GP, Pathak, H, Rai, A, Chinnusamy, V and Rai, RD (2015). Harnessing next generation sequencing in climate change: RNA-Seq analysis of heat stress-responsive genes in wheat (*Triticum aestivum L.*). *Omics: J. Integrative Bio.,* DOI:10.1089/omi.2015.0097.

71. Kumar, S, Tomar, BS, Jain, SK, Singh, N, Parsad, R and Munshi, AD (2015). Effect of planting time and density on plant growth, seed yield and quality attributes in onion

(Allium cepa) cv. Pusa Riddhi. *Ind. J. Agril. Sci.,* **85(12)**, 1578-1585.

72. Kushwaha, B, Kumar, R, Agarwal, S, Pandey, M, Nagpure, NS, Singh, M, Srivastava, S, Joshi, CG, Das, P, Shah, TM, Patel, AB, Patel, N, Koringa, P, Das, SP, Patnaik, S, Bit, A, Sarika, Iquebal, MA, Kumar, D and Jena, JK (2014). Assembly and variation analyses of C. batrachus mitogenome retrieved from WGS data and its phylogenetic relationship with other catfishes. *Meta Gene.*, **5**, 105-114.

73. Lama, A, Jha, GK, Paul, RK and Gurang, B (2015). Modelling and forecasting of price volatility: An application of GARCH and EGARCH Models. *Agril. Eco. Res. Rev.*, **28(1)**, 73-82.

74. Thakre, M, Verma, MK, Singh, K, Awasthi, OP, Varghese, E and Sharma, VK (2015). Effect of nutrition, harvesting date and fruit canopy position on yield andquality of Kinnow mandarin (Citrus nobilis × Citrus deliciosa). *Ind. J. Agril Sci.,* **85(11)**, 1455-1460.

75. Mandadi, N, Hendrickson, C, Handanahal, S, Rajappa, T, Pai, N, Javeed, S, Verghese, A, Rai, A, Pappu, A, Nagaraj, G and Dhingra, A (2015). Genome sequences of Photorhabdus luminescens strains isolated from entomopathogenic nematodes from southern India. *Genomics Data*. doi: 10.1016/j.gdata.2015.07.023

76. Mandal, BN, Parsad, R and Gupta, VK (2016). Cyclic circular balanced and strongly balanced crossover designs through integer programming. *Comm. in Statist.- Theory and Methods*, **45(4)**, 859-871.

77. Meher, PK, Sahu, TK and Rao, AR (2016). Prediction of donor splice sites using random forest with a new sequence encoding approach. *BMC BioData Mining,* **9(4)**, DOI: 10.1186/s13040-016-0086-4.

78. Mishra, S, Behera, TK, Munshi, AD, Bharadwaj, C and Rao, AR (2015). Inheritance of gynoecism and genetics of yield and yield contributing traits through generation mean analysis in bitter gourd. *Ind. J. Hort.*, **72 (2)**, 218-222.

79. Mohd, H, Varghese, C, Jaggi, S and Varghese, E (2016). Triallel cross designs for comparing a set of test lines with a control line. *Ind. J. Genet. Plant Breed.*, **76(1)**, 84-87.

80. Naganagoudar, YB, Kenchanagoudar, PV, Rathod, S, Keerthi, CM, Nadaf, HL and Channappagoudar, BB (2016). Inheritance of fresh seed dormancy in recombinant inbred lines (RIL) developed for mapping population TAG 24 x GPBD 4 in groundnut (Arachis hypogeal L.), *Legume Res.*, DOI: 10.18805/lr.v0iOF.9383.

81. Nandi, PK, Parsad, R and Gupta, VK (2015). Simultaneous optimization of incomplete multi-response experiments. *Open J. Statist.,* **5,** 430-444. doi. http://dx.doi.org/10.4236/ojs.2015.55045.

82. Nath, P, Kaur, C, Rudra, SG and Varghese, E (2016). Enzyme-assisted extraction of carotenoid- rich extract from red capsicum (Capsicum annuum). *Agric. Res.,* DOI 10.1007/s40003-015-0201-7.

83. Nigam, D, Kadimi, PK, Kumar, S, Mishra, DC and Rai, A (2015). Computational analysis of miRNA-targets community network reveals cross talk of different metabolism. *Genomics Data,* **5**, 292-296.

84. Ojha, S and Bhar, LM (2015). Detection of outliers in designed experiments with correlated error. *J. Ind. Soc. Agril. Statist.,* **69(1)**, 57-63.

85. Pal, S and Mazumdar, D (2015). Stochastic modelling of monthly rainfall volume during monsoon season over Gangetic West Bengal, India*. Nature Environ. Pollution Tech.*, **14(4)**, 951-956.

86. Pal, S, Mazumdar, D and Chakraborty, PK (2015). District-wise trend analysis of rainfall pattern in last century (1901-2000) over Gangetic region in West Bengal, India. *J. Appl. Natural. Sci.*, **7(2),** 750-757.

87. Pal, S, Prajneshu and Ghosh, H (2015). Development of a novel Web based WebECGR package for estimation of compound growth rates for monotonically non-decreasing situations. *Agril. Eco. Res. Rev.*, **28(1)**, 163-170.

88. Pal, S, Prajneshu and Ghosh, H (2015). Estimation of compound growth rates for non-monotonic situations through nonlinear growth models using WebECGR package. *J. Ind. Soc. Agril. Statist.*, **69(1)**, 95-100.

89. Pal, S and Mazumdar, D (2015). Forecasting groundnut production of India using nonlinear growth models. *J. Crop Weed*, **11**, 67-70.

90. Panwar, S, Kumar, A, Singh, KN, Gurung, B and Rathore, A (2016). Use of Weather Indices approach in wheat yield crop forecast**.** *Int. J. Tropical Agril.,* ISSN: 0254-8755, 1-4.

91. Paul, AK, Paul, RK, Das, S, Behera, SK and Dhandapani, A (2015). On some development of new nonparametric stability measures. *Ind. J. Agril. Sci.*, **85(8)**, 113-117.

92. Paul, RK (2015). ARIMAX-GARCH-WAVELET model for forecasting volatile data. *Model Assisted Statist. Appl.*, **10(3)**, 243-252.

93. Paul, RK and Birthal, PS (2015). Investigating rainfall trend over India using wavelet technique. *J. Water and Climate Change*, DOI: 10.2166/wcc.2015.079

94. Paul, RK and Sinha, K (2016). Forecasting crop yield: a comparative assessment of ARIMAX and NARX model. *Rashi*, **1(1)**, 77-85.

95. Paul, RK and Sinha, K (2016). Forecasting crop yield: A comparative assessment of ARIMAX and NARX model. *Soc. for Appl. Statist. Agril. Allied Sci.*, **1(10)**, 77-85.

96. Paul, RK, Bhardwaj, SP, Singh, DR, Kumar, A, Arya, P and Singh, KN (2015). Price volatility in food commodities in India- An empirical investigation. *Int. J. Agril. Statist. Sci.*, **11(2)**, 395-401.

97. Paul, RK, Birthal, PS, Paul, AK and Gurung, B (2015). Temperature trend in different agro-climatic zones in India. *Mausam,* **66(4)**, 841-846.

98. Paul, RK, Gurung, B and Samanta, S (2015). Analyzing the effect of dual long memory process in forecasting agricultural prices in different markets of India. *Int. J. Empirical Finance*,**4(4)**, 235-249.

99. Paul, RK, Gurung, B, Samanta, S and Paul, AK (2015). Modeling long memory in volatility for spot price of lentil with multi-step ahead out-of-sample forecast using AR-FIGARCH Model. *Eco. Affairs,* **60(3)**, 457-466.

100. Paul, RK, Rana, S and Saxena, R (2015). Effectiveness of price forecasting techniques for capturing asymmetric volatility for onion in selected markets of Delhi. *Ind. J. Agricl. Sci.*, **86(3)**, 303–309.

101. Paul, RK, Samanta, S and Gurang, B (2015). Monte Carlo simulation for comparison of different estimators of long memory parameter: An application of ARFIMA model for forecasting commodity price. *Model Assisted Statist. Appl.*, **10(2)**, 116-127.

102. Paul, RK, Saxena, R, Chaurasia, S, Zeeshan and Rana, S (2015). Examining export volatility, structural breaks in price volatility and linkages between domestic and export prices of onion in India. *Agril. Eco. Res. Rev.*, **28**, 101-116.

103. Pradhan,UK, Lal,K, Dash, S and Singh, KN (2016). Design and Analysis of Mixture Experiments with Process Variable. *Comm. Statist. - Theory and Methods,* DOI:10.1080/03610926.2014.990104.

104. Raju, BMK, Osman, M, Venkateswarlu, B, Rao, KV, Mishra, PK, Rao, CAR, Kareemulla, K, Rai, A, Bhatia, VK, Sahoo, PM, Malhotra, PK, Sikka, AK, Swapna, N and Latha, P. (2015). Prioritiazation of Rainfed Areas in India based on Natural Resource Endownment. *J. Ind. Soc. Agril. Statist.,* **69(1)** 83-93.

105. Raman, RK, Paul, AK, Das, S and Wahi, SD (2015). Empirical comparison of the performance of linear discriminant function under multivariate non-normal and normal data. *Int. J. Agril. Statist. Sci.*, **11(2)**, 403-409.

106. Rani, V, Dash, S, Nain, L and Arora, A (2015). Expression of novel glucose tolerant â-glucosidase on cell surface by Rhodotorula glutinis isolate. *Biocatalysis Agri. Biotech.,* DOI: 10.1016/j.bcab.2015.06.004.

107. Rao, NS (2015). MAPRIS: A references information system on medicinal and aromatic plants to serve the researchers. *Int. J. Appl. Res. Infor. Tech. and Compu.*, **6(3)**, 154-157.

108. Rao, NS (2016). ICT Applications in medicinal and aromatic plants. *Adv. in Comp. Sci. Inform. Tech***. 3(1)**, 27-29.

109. Rao, NS, Geeta, KA and Maiti, S (2015). Herbal gardens of India: A promising online database. *Adv. Comp. Sci. Inform. Tech***., 2(11),** 74-78.

110. Rao, NS, Geetha, KA and Maiti, S (2015). DHMAPI: A knowledge based system for identification of medicinal and aromatic plants. *Int. J. Appl. Res. Infor. Tech. Compu.*, **6(3)**,177-188.

111. Kumar, R, Bhowmik, A, Chakdar, H, Elumalai, S and Pabbi, S (2015). Biochemical characterization and diversity analysis of cyanobacteria isolated from different locations. *Vegetos*, **28(1)**, 38-48.

112. Rudra, SG, Jakhar, N, Nishad, J, Saini, N, Sen, S, Bhardhwaj, R, Jaiswal, S, Suneja, P, Singh, S and Kaur, C (2015). Extrusion conditions and antioxidant properties of sorghum, barley

and horse gram based snack. *Int. J. Plant Res.*, **28(2)**, 171-182.

113. Saha, S, Walia, S, Kundu, A, Sharma, K, Paul, RK (2015). Optimal extraction and fingerprinting of carotenoids by accelerated solvent extraction and liquid chromatography with tandem mass spectrometry. *Food Chemistry*, **177**, 369-375.
114. Sahoo, PM, Sahoo, RN, Pandya, D and Saran, S (2014). Land Use/Land Cover Mapping using High Resolution Mutlispectral Satellite Data. *J. Agril. Phy.*, 14(2), 201-207.
115. Sahu, TK, Rao, AK, Meher, PK, Sahoo, BC, Gupta, S Rai, A. (2015). Computational Prediction of MHC class I epitopes for most common viral diseases in cattle (Bos Taurus). *Ind. J. Biochem. Biophy.*, **52**, 34-44.
116. Sarkar, RK, Meher, PK, Wahi, SD, Mohapatra, T and Rao, AR (2015). An approach to the development of a core set of germplasm using a mixture of qualitative and quantitative data. *Plant Genet. Resour., Charact. Utilization.* **13(2)**, 96-103.
117. Sarkar, RK, Rao, AR, Meher, PK, Nepolean, T and Mohapatra, T (2015). Evaluation of random forest regression for prediction of breeding value from genome-wide SNPs. *J. Genet.,* **94**, 187-192. DOI:10.1007/s12041-015-0501-5.
118. Saxena, R, Paul, RK, Rana, S, Chaurasia, S, Pal, K, Zeeshan and Joshi, D (2015). Agricultural trade structure and linkages in SAARC: An empirical investigation. *Agril. Eco. Res. Rev.*, **28(2)**, 311-358.
119. Sengupta, A, Grover, M, Chakraborty, A, Saxena, S (2015). HEPNet: A knowledge base model of human energy pool network for predicting the energy availability status of an individual. *PLoS ONE 10(6): e0127918. doi:10.1371/journal.pone.0127918.*
120. Shekhar, S, Bhar, LM and Gupta, VK (2014). Incomplete block designs for multiple asymmetric parallel line assays. *Int. J. Comput. Theo. Statist.*, **1(1)**, 29-35.
121. Singh, A, Sharma, A, Dey, N and Amira S. Ashour (2015). Web recommendation techniques – Status, issues and challenges. *J. Network Comm. Emerg. Techn.*, **5(2)**, 57-65.
122. Singh, BK, Mishra, DC, Yadav, S, Ambawat S, Vaidya, E, Tribhuvan, KU, Kumar, A, Kumar, S, Kumar, S, Chaturvedi, KK, Rani, R, Yadav, P, Rai, A, Rai, PK, Singh, VV, Singh, D (2016). Identification, characterization, validation and cross-species amplification of genic-SSRs in Indian Mustard (Brassica juncea). *J. Plant Biochem. Biotech.,* DOI: 10.1007/s13562-016-0353-y.
123. Singh, NMD, Paul, AK and Paul, RK (2015). Selecting appropriate nonlinear growth models using bootstrap technique. *Ind. J. Anim. Sci.*, **85(8)**, 104-107.
124. Singh, S, Paul, AK, Paul, RK, Bhar, LM, Kumar, A and Alam, W (2015). Study of growth pattern of cattle under different error structures. *Model Assisted Statist. Appl.,* **10**, 109-115.
125. Som, S, Burman, RR, Sharma, JP, Sangeetha, V, Lenin, V and Iquebal, MA (2015). Assessing information need of the stakeholders on good agricultural practices (GAP) for grapes. *Ind. J. Extn. Edu.,* **51(3 & 4)**, 8-12.
126. Som, S, Burman, RR, Sharma, JP, Sangeetha, V, Lenin, V and Iquebal, MA (2015). Designing and validating e-learning Module on Good Agricultural Parctyices (GAP) for grapes. *Ind. J. Hort.*, **72(4)**, 489-493.
127. Srivastava, RP, Singh, J, Singh, D, Gupta, S and Singh, NP (2015). Milling, roasting and cooking effect on neurotoxin and other anti-nutrients of lathyrus (Lathyrus sativus). *Current Adv. Agril. Sci.*, **7(2)**, 154-159.
128. Sud, UC, Aditya, K, and Chandra, H (2015). District level crop yield estimation under spatial small area model. *J. Ind. Soc. Agril. Statist.,* **69(1)**, 49-56.
129. Sundaray, JK, Rasal, KD, Chakrapani, V, Swain, P, Kumar, D, Ninawe, AS, Nandi, S and Jayasankar, P (2016). Simple sequence repeats (SSRs) markers in fish genomic research and their acceleration via next-generation sequencing and computational approaches. *Aquaculture Int.*, 1-14 (http://link.springer.com/article/10.1007/s10499-016-9973-4).
130. Tandon, G, Sarika, Iquebal, MA, Kumar, S, Kaur, S, Rai, A and Kumar, D (2015). Evidence of Salicylic Acid pathway with EDS1 and PAD4 proteins by molecular dynamics simulation for Grape improvement. *J. Biomol. Struct. Dynam.*, **33(10)**, 2180–2191.
131. Tara Satyavathi, C, Mukesh Sankar, S, Singh, SP, Sharma, R and Varghese, E (2015). Evaluation of newly developed white grain pearl millet lines against downy mildew cited

by Sclerospora graminicola. *Int. J. Tropical Agric.*, **33(2)**, 1381-1386.

132. Thakre, M, Verma, MK, Singh, K, Awasthi, OP, Varghese, E and Sharma, VK (2015). Effect of nutrition, harvesting date and fruit canopy position on yield and quality of kinnow mandarin (*Citrus nobilis* × *Citrus deliciosa*). *Ind. J. Agril. Sci.,* **85(11)**, 1455-1460.
133. Varghese, C, Varghese, E, Jaggi, S and Parsad, R (2015). Row-column designs for diallel cross experiments with specific combining abilities. *J. Ind. Soc. Agril. Statist.,* **69 (2)**, 201-225.
134. Varghese, C, Varghese, E, Jaggi, S and Bhowmik, A (2015). Experimental designs for open-pollination in polycross trials. *J. Appl. Statist.,* **42(11)**, 2478-2484. *DOI*: 10.1080/02664763.2015.1043860.
135. Varghese, E and Varghese, C (2015). Variance balanced row-column designs involving diallel crosses incorporating specific combining abilities for comparing test lines with a control line. *Comm. Statist. Theory Methods* DOI:10. 1080/03610926.2015.1032428.
136. Wani, MH, Bazaz, NH, Paul, RK, Showkat, AI and Bhat, A (2015). Inter-sectoral linkages in Jammu and Kashmir economy - An econometric analysis. *Agril. Eco. Res. Rev.*, **28**, 11-24.
137. Wani, MH, Paul, RK, Bazaz, NH and Bhat, A (2015). Market integration and causality in pear in India. *Econ. Affairs-Quarterly J. Eco.,* **60 (4)**, 735-740.
138. Wani, MH, Paul, RK, Bazaz, NH and Manzoor, M (2015). Market Integration and price forecasting of apple in India. *Ind. J. Agril. Eco.*, **70 (2)**, 169-181.
139. Wani, MH, Sehar, H, Paul, RK, Kuruvila, A and Hussain, I (2015). Supply response of horticultural crops: A case of apple and pear in Jammu and Kashmir, India. *Agril. Eco. Res. Rev.,* **28(1)**, 83-89.

Popular Article

- Gupta, VK, Mandal, BN and Parsad, R (2015). History of Statistics on Timeline. Aavailable at http://sample.iasri.res.in/ssrs/history.pdf.
- Saha, ND, Saha, P, Gurung, B and Bhowmik, A (2015). Application of plant growth promoting rhizobacteria (PGPR) for enhanced crop growth. *Krishisewa: Agriculture Information Hub of Indian Farmers*. Available at http://www.krishisewa.com/articles/soil-fertility/636-pgpr-crop-growth.html.

सांख्यिकी विमर्श 2015-16 मे प्रकाशित लेख

- अशोक कुमार गुप्ता, विजय बिन्दल एवं ऊषा जैन (2016)। संस्थान के कीर्तिस्तम्भ : प्रोफेसर सुखदेव शर्मा, 1-4
- शशि भूषण लाल, अनिल राय, कृष्ण कुमार चतुर्वेदी, अलवप्पा बी. अंगदी, मो. समीर फारुकी एवं अनु शर्मा (2016)। कृषि में मोबाइल क्लाउड कंप्यूटिंग की उपयोगिता, 15-20
- अर्पण भौमिक, एल्दो वरगीस, सीमा जग्गी, सिनी वरगीस एवं विजय बिन्दल (2016)। रन अनुक्रमों में न्यूनतम परिवर्तन के साथ बहु-उपादानी परीक्षण : एक सिंहावलोकन, 21-27
- प्राची मिश्रा साहू, उमेश चन्दर सूद, तौकीर अहमद एवं नीलम चंद्रा (2016)। भारत में जूट की खेती, उत्पादन व उपयोग, 28-34
- कृष्ण कुमार चतुर्वेदी, अनिल राय, शशि भूषण लाल, अलवप्पा बी. अंगदी, मो. समीर फारुकी एवं अनु शर्मा (2016)। अशोका: कृषि जैव सूचना के लिए सुपर कंप्यूटिंग की स्थापना, 35-40
- अंकुर बिश्वास, कौशतव आदित्य, वन्दिता कुमारी, राजू कुमार एवं अशोक कुमार गुप्ता (2016)। सर्वेक्षण आँकड़ों के सांख्यिकीय विश्लेषण में एसपीएसएस का उपयोग, 41-.47
- सिनी वर्गीस, सीमा जग्गी, एल्दो वर्गीस, अर्पण भौमिक एवं ब्रह्मजीत गहलौत (2016)। समूह विभाज्य नीड़ित अभिकल्पनाऐं, 48-52
- अजीत, विजय बिन्दल, नरेश चन्द, फणीन्द्र पाल सिंह, अनिल कुमार एवं उमा (2016)। वृक्ष आयतन एवं द्रव्यमान प्रारूपों का विकास, आकलन एवं सत्यापन पद्धतियां : सांख्यिकीय संधारणाएं, 53-62
- कौशतव आदित्य, वन्दिता कुमारी, राजू कुमार, अंकुर विश्वास, हुकुम चंद्रा एवं मान सिंह (2016)। जिला स्तरीय धान की उपज के आकलन के लिए स्थानिक लघु-क्षेत्र मॉडल, 63-68
- द्विजेश चन्द्र मिश्र, इन्द्रा सिंह, संजीव कुमार एवं सुधीर श्रीवास्तव (2016)। प्रोटीन-प्रोटीन इंटरेक्शन, 69-73
- मीर आसिफ इकबाल, सरिका, विजय बिन्दल, यास्मिन, अनिल राय एवं दिनेश कुमार (2016)। प्रतिचित्रण एवं किस्म पहचान के लिए टमाटर का माइक्रोसेटेलाइट डी. एन.ए. मार्कर डाटाबेस 74-79
- अशोक कुमार गुप्ता एवं विजय बिन्दल (2016)। जीवन तालिकाऐं 80-86

- मान सिंह एवं उमेश चन्दर सूद (2016)। फसलों की बुवाई पंक्तियों में एक दिशा में होने पर उपज आकलन के लिए फसल कटाई प्रयोग विधि, 87-99
- हिमाद्रि घोष एवं सविता वधवा (2016)। पूर्वानुमान के लिए एल-आर फज़ी सेट्स और उनके प्रयोग पर आधारित उन्नत फज़ी काल-श्रृंखला पद्धति, 100-106
- वन्दिता कुमारी, राजू कुमार, कौशतव आदित्य, अमरेंद्र कुमार, अंकुर विश्वास एवं अशोक कुमार गुप्ता (2016) क्रमसूचक लॉजिस्टिक समाश्रयण के उपयोग से गेहूं के फसल की उपज का पूर्वानुमान, 107-111
- सिनी वर्गीस, सुकान्त दाश, अर्पण भौमिक एवं देवेन्द्र कुमार (2016)। एकीकृत कृषि प्रणाली पर अखिल भारतीय संचालित अनुसंधान परियोजना ऑन-फार्म परीक्षण, 112-114
- मीर आस्कि इकबाल, सारिका, सुशील कुमार सरकार, अनिल राय एवं दिनेश कुमार (2016)। कृत्रिम तंत्रिक नेटवर्क पद्धति के द्वारा मवेशियो के रोगाणुरोधी पेप्टाइडस् की पहचान एवं वर्गीकरण, 115-121
- बैद्य नाथ मण्डल, सुकांत दाश एवं देवेन्द्र कुमार (2016)। R सॉफ्टवेयर द्वारा सहसंबंध एवं समाश्रयण विश्लेषण, 122-126
- प्रकाश कुमार, सुशील कुमार सरकार, सुकांत दाश, मृण्मय रे एवं संतोष राठौड (2016)। कृषि विकास में वृहद आँकड़ो का महत्व, 127-130
- राजेन्द्र सिंह तोमर एवं प्रमोद कुमार (2016)। एस.ए.एस. मैक्रो : एक अवलोकन, 131-137
- धर्मराज सिंह, प्रमोद कुमार, अनिल कुमार, सुरेश ए. कुस्प, प्रवीण आर्य एवं शिव कुमार (2016)। उत्तर-पश्चिम राजस्थान के नहरी क्षेत्रों में जल भूजल विकास, 138-141
- बैद्य नाथ मण्डल, सुकांत दाश, उमेश चन्द बन्दूनी एवं देवेन्द्र कुमार (2016)। R साफ्टवेयर द्वारा सार्थकता परीक्षण, 142-144
- अमृत कुमार पॉल, रंजित पॉल, वसी आलम एवं सत्यपाल सिंह (2016)। संकर नवजात सूअरों के शरीर के विकास के लिए मॉडलिंग, 145-148
- ऊषा जैन (2016)। संस्थान की राजभाषा यात्रा : 2015-16, 149-151

Papers in Conference Proceedings

- Proceedings of the 10th INDIACom; INDIACom-2016; IEEE Conference ID: 37465 3rd 2016 International Conference on Computing for Sustainable Global Development during 16–18 March 2016 Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi (INDIA).
  - Bharadwaj, A, Chowdhary, IP, Islam, SN, Chaturvedi, KK, Sahoo, PM and Paul, RK (2016). Interpolating Climate Data using wTICD: A Web Based Tool.
  - Kumar, M, Gupta, A, Amrapali, S, Agrawal, PK, Mahajan, V, Kant, L and Bisht, JK E-Resource for DUS Characterization of Maize Varieties and Inbreds.
  - Subashchandra, Arora, A, Kumar, A, Jain, R, Marwaha, S and Mishra, T. Online Software for Forewarning of Onion Thrips.
- Majumdar, PG, Rai, N, Mishra, DC, Kumar S, Rai, A, Chaturvedi, KK, Lal, SB, Kumar, A, Archak, S and Farooqi, MS (2016). Genome Analysis of Rhizobium Species using Codon Usage Bias Tools. In proceedings of International Conference on Bioinformatics and Systems Biology organized by IIIT Allahabad during 4-6 March 2016. IEEE #38295.

Pocket Diary

- Gupta, VK, Parsad, R and Mandal, BN (2015). Significance of Experimental Designs in Agricultural Research.

Book

- Gupta, VK, Prasad, R, Bhar, LM and Mandal, BN (2016), Statistical Analysis of Agricultural Experiments (Part-I; Single Factor Experiments). *ICAR-Indian Agricultural Statistics Research Institute, New Delhi*. ISBN Number: 987-93-5265-859-6
- Sud, UC, Chandra, H, Bhar, LM and Sarkar, SK (2015). Statistics and Informatics in Agricultural Research. Excel India Publication, India. ISBN Number: 978-93-84869-98-4.
- Chandra, G, Nautiyal, R and Chandra, H (2015). Statistics in Forestry: Methods and Applications. Bonfring Publication, India. ISBN Number: 978-93-84743-83-3.

Book Chapter

- Goyal, RC, Marwaha, S, Grover, RB and Dahiya, R (2015). E-KrishiShiksha: An e-Learning Portal on Agricultural Education in Envisioning the Library of the Future, Editors: K. Veeranjaneyulu, G.Rathinasabapathy, Rajive K. Pateria, BS Publications, ISBN 978-93-83635-58-0, 18-29.
- Arora, A, Jain, R. Clustering: Case Studies in Agriculture. Decision Support System in Agriculture using Quantitative Analysis, (2015, Eds. Rajni Jain and SS Raju), ISBN : 978-81-8321-395-0, 271-283.

- Angadi, UB and Chaturvedi, KK (2016). ICT in Agriculture. Analytical Techniques for Decision Making in Agriculture. (Eds. Raju, S., Jain, R and Ahuja U). Daya Publishing House®, A Division of Astral International Pvt. Ltd.New Delhi., 253-264.
- Angadi, UB, Jash, S, Devi, L and Anandan, S(2016). Database and Expert System on Animal Feed Resources:A Case Study. Analytical Techniques for Decision Making in Agriculture, Year : 2016 , Astral International Pvt Ltd, New delhi 110002.
- Arora, A and Jain, R (2015). Clustering: Case studies in agriculture, 271-283. *Decision support system in agriculture using quantitative analysis. Agrotech Publishing Academy, ISBN: 978-81-8321-395-0.*
- Mandal, BN, Gupta, VK and Parsad, R Distance Balanced Sampling Plans: An Overview. In: Statistical and Mathematical Sciences and Their Applications (2015) (Eds: Neeraj Tiwari. Narosa Publishing House, New Delhi (ISBN: 978-8487-520-1). 74-81.
- Berg, E, Chandra, H and Chambers, R (2015). Small area estimation for skewed data. Chapter in the edited book on Small Area Methods for Poverty and Living Conditions Estimates (edn. Pratesi, M.), Wiley & Sons.
- Bhar, LM (2015). Regression analysis diagnostics and remedial measures. *Decision support system in agriculture using quantitative analysis. Agrotech Publishing Academy, ISBN: 978-81-8321-395-0.* 245-270.
- Chandra, H (2015). Ratio and Regression Estimation in Survey Sampling. Statistics and Research, Uttar Pradesh Rajarshi Tandon Open University, Allahabad.
- Chandra, H (2015). Small area estimation under Transformation. Chapter in the edited book on Statistical and Mathematical Sciences and their Applications (Eds. Tiwari, N.), Narosa Publishing House, New Delhi.
- Chandra, H and Chandra, G (2015). An Overview of Small Area Estimation Techniques. Chapter in the edited book on Role of Applied Statistics and its Application in Forestry (Eds. Chandra, *et al*.), Bonfring Publication.
- Chandra, H, Chambers, R and Salvati, N (2015). Model based direct estimator for estimation of distribution function. Chapter in the edited book on Small Area Methods for Poverty and Living Conditions Estimates (Eds. Pratesi, M.), Wiley & Sons.
- Chandra, H, Sud, UC and Chandra, G (2015). Importance of Statistical Software in Survey Data Analysis. Chapter in the edited book on Role of Applied Statistics and its Application in Forestry (Eds. Chandra, et al.), Bonfring Publication.
- Jaggi, S, Varghese, C, Varghese, E and Bhowmik, A (2015). Statistical Designs for Forestry Research. Statistics in Forestry: Methods and Applications (Eds. Girish Chandra, Raman Nautiyal, Hukum Chandra, Nilanjan Roychoudhury and Naseer Mohammad) Bonfring, Coimbatore. 13-24. ISBN: 978-93-84743-83-3.
- Lal, K, Parsad, R and Gupta, VK (2015). Trend free block designs under a heteroscedastic model. Statistics and Informatics in Agricultural Research, Indian Society of Agricultural Research, New Delhi (Eds. UC Sud, Hukum Chandra, LM Bhar, Susheel Kumar Sarkar)
- Rao, N Srinivasa, Choubey, AK, Arora, Alka, Marwaha, Sudeep, Kumar, Mukesh, Chand, Subhash and Saini, RK (2016). Data Center and its services in ICAR. Analytical Techniques for Decision Making in Agriculture. Astral International Pvt. Ltd., New Delhi., 299-308.
- Jambhulkar, Nitiprasad N, Lal, Krishan, Parsad, Rajender and Gupta, VK (2015). Minimum Aberration Fractional Factorial Plans for Multi-level Experiments. In: Statistical and Mathematical Sciences and Their Applications: (Eds: Neeraj Tiwari. Narosa Publishing House, New Delhi), ISBN: 978-8487-520-1. 41-73.
- Paul, RK (2015). Introduction to time series modelling. Ram Singh and S.M. Feroze Edition. Agribusiness Management, Biotech Books, ISBN: 978-81-7622-350-8, 195-206.
- Paul, RK (2015). Linear time series analysis, Rajni Jain and SS Raju Edition. Decision support system in agriculture using quantitative analysis, Agrotech Publishing Academy, ISBN: 978-81-8321-395-0, 284-297.
- Paul, RK (2015). Nonlinear Time-Series Analysis: An application of GARCH model. Rajni Jain and SS Raju Edition. Decision support system in agriculture using quantitative analysis, Agrotech Publishing Academy, ISBN: 978-81-8321-395-0, 298-306.
- Rao, NS, Choubey, AK, Arora, A, Marwaha, S, Kumar, M, Chand, S and Saini, RK (2016). Data Center and its services in ICAR. Analytical Techniques for Decision Making in Agriculture.

Astral International Pvt. Ltd., New Delhi, 299-308.

- Sharma, P, Diwedi, S and Singh, D (2015). Global Poverty, Hunger, and Malnutrition: A Situational Analysis. Biofortification of Food Crops, 1st ed. 2016, X, 480 p. 63 illus., 54 illus. in color
- Pal, S (2015). Multivariate analysis using MS-EXCEL. National Workshop cum Training Programme on Statistical Tools for Research Data Analysis. New Delhi, Anik Publication, (Eds., PK Sahu), 165-173).
- Statistical and Mathematical Sciences and their Applications, edited by Neeraj Tiwari. Narosa Publishing House, New Delhi, 2015 (ISBN: 978-8487-520-1).
  - Chandra, H. Small area estimation under transformation, 22-34.
  - Jambhulkar, NN, Lal, K, Parsad, R and Gupta, VK. Minimum aberration fractional factorial plans for multi-level experiments, 41-73.
  - Mandal, BN, Gupta, VK and Parsad, R. Distance balanced sampling plans: An overview. 74-81.
- Statistics and Informatics in Agricultural Research (Eds. UC Sud, H Chandra, LM Bhar, and S Sarkar, (2015), Excel India Publication, New Delhi.
  - Aditya, K and Sud, UC. Higher order calibration estimators under two stage sampling, 141-149.
  - Arora, A, Marwah, S and Alam, AKMS. Decision support system for effective management of ICAR sponsored trining programms, 338-347.
  - Bhardwaj, SP. Study of price volatility in pulse crops-A case study of masoor grain, 260-275.
  - Chandra, H, Aditya, K, Maheshwari, S and Panna, NR. Micro level crop yield estimation - An application of small area estimation technique, 150-161.
  - Choubey, AK, Arora, A, Marwaha, S, Kumar, M, Rao, NS, Dahiya, S, Bhardwaj, A, Islam, SN, Singh, P and Ahuja, S. E-governance through enterprise resource planning system in ICAR, 306-320.
  - Guha, S, Chandra, H and Sud, UC. Outliers robust generalized regression estimators for finite population total, 183-193.
  - Gurung, B, Paul, RK, Singh, KN and Panwar, S. Use of particle swarm optimization technique in time-series analysis, 240-243.
  - Kumar, M, Choubey, AK, Arora, A, Marwaha, S, Dahiya, S, Bhardwaj, A, Rao, NS, Islam, SN and Ahuja, S. E-human resources management system in ICAR, 321-337.
  - Lal, K, Parsad, R and Gupta, VK. Trend free block designs under hetroscedastic model, 215-226.
  - Lama, A, Jha, GK, Paul, RK. Modeling agricultural commodity price volatility using GARCH model with structural break, 227-233.
  - Pal, S and Mazumdar, D. Long term trend analysis of temperature over India, 244-259.

E-learning Portal

- Goyal, RC, Sudeep, Grover, RB and Dahiya, R (2015). E-Krishi shiksha: An e-learning portal on agricultural education in envisioning the library of the future. (2015, Eds. K. Veeranjaneyulu, G.Rathinasabapathy, Rajive K. Pateria), BS Publications, ISBN 978-93-83635-58-0,18-29.

Training/Reference Mannual

- एस.पी.एस.एस. द्वारा आंकड़ों का विश्लेषण एवं रिपोर्ट सृजन (2015, Eds. अपर्ण भौमिक एवं एल्दो वर्गीस)।
- Accelerating data-intensive genome analysis in wheat. (2015, Eds. Sarika, Sharma, P, Sheoran, S, Mamrutha, HM, Iquebal, MA, Tiwari, R, Rai, A and Kumar, D)
- Applications of Computer Algorithms and Statistical Software Packages in Agriculture (2015, Eds. Sangeeta Ahuja and Pratap Singh).
- Bioinformatics and high dimensional genome data analysis (2015, Eds. Rao, AR and Meher, PK)
- Bioinformatics Tools for Fish Genomics. (2015, Eds. Iquebal, MA, Sarika, Sahoo, L, Rasal, DK, Sundaray, JK, Rai, A and Kumar, D).
- Crop Cutting Experiments Technique (2015, Eds. Ahmad, T. and Choudhary, VK)
- Data Analysis and Interpretation. (2015 Eds. Parsad, Rajender and Bhowmik, Arpan).
- Designing and Analysis of Experiments, Reference Manual, IASRI, New Delhi. (2015, Eds. Sarkar, S and Dash, S).
- Experimental Data Analysis (2015, Eds. Seema Jaggi and Eldho Varghese).
- Integrated sample survey methodology. (2015, Eds. Chandra, H and Aditya, K).
- प्राकल्पना का परीक्षण (Testing of Hypothesis) (2015, Eds. एल्दो वर्गीस एवं सुनील कुमार यादव).
- Manual on Price Forecasting Techniques (2015,

Eds. Saxena, R, Pavithra S. Paul, RK, Chayal, S and Chaurasia, S), Published by NIAP, New Delhi

- Recent Advances in Next Generation Sequencing Data Analysis (2016, Eds. Grover, M and Mishra, DC)
- Recent Advances in Statistical Genetics and Genomics (2016, Eds. Meher, PK and Pradhan, UK)
- Sample Survey and Sampling Design (2015, Eds. Ahmad, Tauqueer and Biswas, Ankur).
- Small Area Estimation Techniques and Applications (2015, Eds. H Chandra and K Aditya).
- Statistical Advances for Technological Enhancement in Agricultural Research (2015, Eds. Bhowmik, A and Varghese, C).
- Use of Models in Crop Yield Estimation. (2015, Eds. Chandra, H. and Kumar, R)
- उन्नत सॉफ्टवेर पकेज़ों का प्रयोग करते हुए कृषि में पूर्वानुमान तकनीकों का प्रयोग (2016, Eds., Wasi Alam and Kanchan Sinha)
- Computational Tools and Techniques for Molecular Data Analysis in Agriculture - Volume I. (2016, Eds Sarika, Mir Asif Iquebal, Manjeet Kaur, Anil Rai and Dinesh Kumar)
- Computational Tools and Techniques for Molecular Data Analysis in Agriculture - Volume II. (2016, Eds Sarika, Mir Asif Iquebal, Manjeet Kaur, Anil Rai and Dinesh Kumar)

Operating Manual

- Ahmad, T, Sud, UC, Sahoo, PM, Pathak, GM and Singh, M (2015). Operating Manual for implementation of alternative sampling methodology for estimation of cotton production using double sampling approach. ICAR-IASRI, New Delhi Publication.

e-Manuals

- Ahmad, T and Choudhary, VK (2015). crop Cutting Experiments Technique: Reference Manual ICAR-IASRI, Ndew Delhi Publication.
- Ahmad, T and Biswas, A (2015). Training manual on Sample Survey and Samping Design: Reference manual. ICAR-IASRI, New Delhi Publication.
- Prasad, R and Bhowmik, A (2015) Data Analysis and Interpretation: Reference manual ICAR-IASRI, New Delhi Publication.

Project Report Published

- Ahmad, T, Bhatia, VK, Sud, UC, Rai, A and Sahoo, PM (2015). Study to develop an alternative methodology for estimation of cotton production (consultancy mode) I.A.S.R.I./P.R.-07/2015
- Bhardwaj, SP, Singh, DR, Singh, KN, Paul, RK and Panwar, S (2015). Forcasting agricultural commodity prices using time series data AGENIASRISIL201300300004 I.A.S.R.I./P.R.-02/2015
- Goyal, RC, Singh, Pal, Malhotra, PK, Marwaha, S and Arora, A (2015). Project information and management system of ICAR. I.A.S.R.I./P.R.-12/2015
- Gurung, B, Ghosh, H and Paul, RK (2015). A study on STAR and SV families of nonlinear time-series models fopr describing cyclicity and volatility in agriculture GENIASRISIL201300800009 I.A.S.R.I./P.R.-08/2015
- Lal, SB, Sharma, A and Sarika (2015). Parallelized workflows for gene prediction, phylogenetic analysis and primer designing SIX1219 I.A.S.R.I./P.R.-01/2015
- Meher, PK, Wahi, SD and Rao, AR (2015). Development of statistical approach for prediction of Eukaryotic splice sites AGENIASRISIL201301300014. I.A.S.R.I./P.R.-11/2015
- Paul, RK (2015). Enhancing resilience of agriculture to climate change through institutions, technologies and policies (NICRA) COP1112 I.A.S.R.I./P.R.-06/2015
- Paul, RK, Ghosh, H and Gurung, B (2015). A study on modelling and forecasting of time-series with long memory processes AGENIASRISIL201300700008 I.A.S.R.I./P.R.-05/2015
- Sharma, NK and Dash, S (2015). Planning, Designing and Analysis of On-farm research experiments planned under the project directorate of farming system research SIX0704 I.A.S.R.I./P.R.-04/2015
- Srivastava, S, Lal, SB and Mishra, DC (2015). Methodology for protein structure comparison and its web implementation AGENIASRISIL201300600007 I.A.S.R.I./P.R.-03/2015
- Sud, UC, Ahmad, T and Jain, VK (2015). District level poverty incidence estimation from NSSO data using small area estimation technique SOX1009 I.A.S.R.I./P.R.-09/2015

- Dash, Sukant, Sharma, NK, Prasad, Kamta and Ravisankar, N (2015). Summarisation of Experiment on sustainable production system in different agro-climate zones (2000-2012), I.A.S.R.I./P.R.-10/2015

Technical Reports Published

- Ahmad, T, Sud, UC and Sahoo PM (2016). Infrastructure report on Organizational structure and man power requirements, their role and functions along with budget requirement for implementation of alternative sampling methodology developed by ICAR-IASRI for estimation of area and production of horticultural crops. ICAR-IASRI, New Delhi Publication.
- Ahmad, T, Sud, UC, Sahoo PM and Singh, M (2015). Instruction manual for primary data collection for horticulture survey under the project "Study to test the developed alternative methodology for estimation of area and production of horticultural crops: IASRI Component of CHAMAN Program under MIDH". ICAR-IASRI, New Delhi Publication.
- Ahmad, T, Sud, UC, Sahoo PM and Singh, M (2015). Instruction manual (Hindi version) for primary data collection for horticulture survey under the project "Study to test the developed alternative methodology for estimation of area and production of horticultural crops: IASRI Component of CHAMAN Program under MIDH". ICAR-IASRI, New Delhi Publication.
- Ahmad, T, Sud, UC, Sahoo PM and Singh, M (2015). Schedules for primary data collection for horticulture survey under the project "Study to test the developed alternative methodology for estimation of area and production of horticultural crops: IASRI Component of CHAMAN Program under MIDH". ICAR-IASRI, New Delhi Publication.
- Sud, UC, Ahmad, T, Gupta, VK, Chandra, H, Sahoo, PM, Aditya, K, Singh, M and Biswas, A (2016). Synthesis of Literature and Framework under the project "Research on Improving Methods for Estimating Crop Area, Yield and Production under Mixed, Repeated and Continuous Cropping". Working Paper No. 5. Global Strategy, FAO, Rome Publication. Available at: http://gsars.org/wp-content/uploads/2016/01/WP_Synthesis-of-Literature-and-Framework_Improving-Methods-for-Estimation-of-Crop-Area-190116.pdf.
- Sud, UC, Ahmad, T, Gupta, VK, Chandra, H, Sahoo, PM, Aditya, K, Singh, M and Biswas, A (2015). Gap Analysis and Proposed Methodologies for Estimation of Crop Area and Crop Yield under Mixed and Continuous Cropping under the project "Research on Improving Methods for Estimating Crop Area, Yield and Production under Mixed, Repeated and Continuous Cropping". Working Paper No. 4. Global Strategy, FAO, Rome Publication. Available at: http://gsars.org/wp-content/uploads/2015/12/WP-2-on-Improving-Methods-for-Estimation-of-Crop-Area-and-Crop-yield-under-Mixed-and-Continuous-Cropping-141215.pdf.

Technical Bulletin Published

- Sud, UC, Gupta, AK, Sahoo, PM and Biswas, A (2015). Agricultural Research Data Book 2015. ICAR-IASRI, New Delhi Publication.
- Gupta, AK, Kumar, A, Sarkar, SK, Mishra, DC, Singh, SK, Bindal, V, Kumar, S, Gahlot, BJ and Jain, U (2015-16). Sankhiyiki Vimarsh, ICAR-IASRI, New Delhi Publication.

Workshop Document

- Varghese, C, Dash, S, Bhowmik, A and Sarkar, SK (2015). Farmer Participatory Farming Systems Research under AICRP on IFS: Methodology & Statistical Tools. IASRI Publication.

Databases Developed

- Brassica SSR database and web tools for accessing the information (MA Iquebal, Sarika, UB Angadi, Anil Rai and Dinesh Kumar).
- CearlESTDb: A database for abiotic stress genes, their annotation and pathways of cereal crop has been developed. (Sanjeev Kumar, DC Mishra, Anil Rai, KK Chaturvedi, SB Lal and M Grover).
- Mango SNPs database developed and web tools developed for browsing mango SNPs (MA Iquebal, Sarika, UB Angadi, Anil Rai and Dinesh Kumar).
- Wheat in-silico and experiments SSR database and web portal development (UB Angadi)

Macros Developed

- SAS code for selection of sample for crop area enumeration for the project "Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" for Rwanda.
- R code for selection of sample for crop area enumeration for the project "Study on improving methods for estimating crop area, yield

and production under mixed, repeated and continuous cropping" for Jamaica.

- R code for selection of tehsils and villages in each district of the states of Gujarat, Uttar Pradesh, Assam, Karnataka and Odisha under the project Pilot study for developing State level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanathan Committee report.
- SAS Macro for Generation of help replicate of 92^k factorial with minimally changed run sequences.

E Resources

- Bhowmik, A and Varghese, C (2015). Statistical Advances for Technological Enhancement in Agricultural Research. Reference Manual (Vol-I and II). IASRI Publication available at http://cbp.icar.gov.in/EBook.aspx
- Gupta, VK, Mandal, BN and Parsad, R (2015). History of Statistics on Timeline. Aavailable at http://sample.iasri.res.in/ssrs/history.pdf.
- Prasad, R and Bhowmik, A (2015). Data Analysis and interpretation.

The following reference manual for different functional areas of ICAR Data Centre Operations have been prepared and made available at server \\10.100.3.72\icar-dc for internal users. (2015) Choubey, AK, Marwaha, Sundeep, Arora, Alka, Rao, NS, Kumar, Mukesh, Saini, Rakesh, chand, subhash.

- Exchange & Lync (39)
- Storage & backup (30)
- Linux (26)
- Windows & Hyper-V (31)
- Helpdesk (4)
- Process (50)
- Network & Security (31)
- Database (36)

Leaflet Brochure Published

- Bhowmik, A and Varghese, C. "Statistical Advances for Technological Enhancement in Agricultural Research".
- भौमिक, अर्पण एवं वर्गीस, सिनी। कृषि अनुसंधान में प्रौद्योगिकीय उन्नति के लिए सांख्यिकीय विकास।
- Grover, M and Mishra, DC. "Recent Advances in Next Generation Sequencing Data Analysis".
- Kumar, D and Sarika."Computational Tools and Tehniques for Molecular Data Analysis in Agriculture".
- Meher, P K and Pradhan, UK "Recent Advances in Statistical Genetics and Genomics"
- Rao, AR and Meher, PK. Bioinformatics and high dimensional genome data analysis.
- Two Leaflet brochure were prepared and published by the Division of Sample Surveys on the following topics:
- i) Division of Sample Survey: A brief Profile
- ii) Applications of Remote Sensing and GIS and Agricultural Surveys.
- A poster on the topic "Crop Cutting Experiment (CCE) technique for determination of yield rates of different crops in India" was prepared by the Divisioin of Sample Surveys and has been displayed in the SMD corridor.

Other Periodic Publications

- Annual Report 2014-15
- ICAR-IASRI News (quarterly)
- सांख्यिकी-विमर्श 2015-16, अंक 11

9

Consultancy and Advisory Services

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

International Consultancy

Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping.

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

Under this project, sampling methodologies for estimation of crop area and yield under mixed and continuous cropping have been developed for different situations prevailing in different countries. Three different approaches namely, (i) Cadastral map based approach, (ii) Area Frame approach and (iii) Household approach have been proposed under this study. Technical Report-1 on "Synthesis of Literature and Framework" and Technical Report -2 on "Gap Analysis and Proposed Methodologies for Estimation of Crop Area and Crop Yield under Mixed and Continuous Cropping" were submitted and both the Reports were accepted and published by the FAO. Field Test Protocol (FTP) document was also prepared and submitted to FAO, and is also accepted for publication. Presentations on Technical Report-1, Technical Report-2 and FTP were made in the Expert Group Meeting during April 15-16, 2015 and in Scientific Advisory Committee (SAC) meeting during June 26-28, 2015 at FAO Headquarter, Rome.

The developed methodology is being field tested in the three identified countries by the FAO, one each in Asia-Pacific, Africa and Latin America/Caribbean region, i.e. Indonesia, Rwanda and Jamaica respectively. Questionnaires were designed for primary data collection on crop area and crop yield for developed alternative methodologies proposed under three different approaches and Instruction Manuals for filling up the questionnaires were also prepared for all the three approaches. Class room training as well as Field training for filling up schedules and different methods of conducting Crop Cutting Experiments was imparted by ICAR-IASRI officials to the Enumerators, Supervisors/Master trainers and nominated officials in all the three countries. Primary data collection is in progress in Indonesia, Rwanda and Jamaica using Computer Assisted Personal Interviewing (CAPI) and Paper Assisted Personal Interviewing (PAPI) methods.

The questionnaires developed for primary data collection in Indonesia have been designed using CAPI designer and are being designed for Rwanda and Jamaica. In-house server at ICAR-IASRI has been set up and configured for the CAPI software

Training imparted in Indonesia by ICAR-IASRI Officials

Training imparted in Rwanda by ICAR-IASRI Officials

Training imparted in Jamaica by ICAR-IASRI Officials

and the data from the field is being uploaded by the Enumerators/Field Investigators of Indonesia to the ICAR-IASRI server dedicated for this purpose and will be uploaded by the Enumerators of Rwanda and Jamaica shortly.

Advisory Services

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

- Dr. Anita Malhotra, Associate Professor, University of Delhi was advised on suitable statistical techniques for analysis of data on April 25, 2015.
- Analysis of data (RBD design in SAS 9.2) of i) Mr. Sunder Pal Kantiya, Ph. D. scholar, GB Pant Agril. University for his Ph.D. thesis entitled "Mutation breeding through gamma radiation in dahlia crop" on April 18, 2015 and ii) Mr. Arjun Sutagatti, Institute of Agricultural Sciences, BHU for his M.Sc. thesis entitled "Bio-epicasy of insecticides against major insect pest of rice" on April 27, 2015.
- Dr. VK Mishra, Department of Genetics and Plant Breeding, BHU, Varanasi on SAS Code for

performing Principal Component Analysis.

- Dr. Anita Malhotra, Associate Professor, University of Delhi, on suitable statistical techniques for analysis of data on May 02, 2015.
- Provided the concept of different type of coefficient of determination to Dr. VK Mishra, Professor, Genetics and Plant Breeding, BHU, Varanasi.
- Analyzed data in Matlab of Mr. Anand Kumar, M. Tech., student, UAS, Raichur for his M. Tech. Thesis on application of ANN in forecasting ground water recharge on May 08, 2015.
- Analyzed colour index data of Dr. Madhubala Thakrey, Scientist, IARI.
- Mr. Azizullah Khalili, a researcher from Kabul, Afghanistan on the procedure of analysis of experiments involving two factors (each at 3 levels) along with 2 control treatments. The analysis has also been done by developing appropriate contrasts as well as computer program using SAS and Dr. Parihar, Scientist from ICAR-IIMR on the use of Proc mixed of SAS for combined analysis of data obtained over years from split plot design.
- Dr. Swaran Lata, Professor (Plant Breeding), Department of Crop Improvement, College of Agriculture, 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 45 cultivars of maize conducted using an alpha design in 2 replications and 15 blocks of size 3 per replication.
- Dr. K Alivelu, Senior Scientist, ICAR-Indian Institute of Oilseeds Research, Hyderabad Advised on randomized layout of alpha designs in (i) v=170, r=2, k=17, k=10; (ii) v=260, r=2, k=13, k=20, k=10; (iii) v=330, r=2, k=11, k=10, k=15 for experiments to be conducted under National Crossing Programme on Sunflower.
- Dr. Anju Kamra, Principal Scientist, Division of Nematology, ICAR-IARI, New Delhi on analysis of data pertaining to 5 experiments completely randomized design.
- Dr CR Mehta, Project Coordinator (FIM), CIAE, Bhopal, M. P. on sampling design.
- Dr Tushar Kumar Mohanty, NDRI, Karnal on performing repeated measurement analysis data sets on cattle.
- Dr Ashim Kumar Biswas, Central Avian Research Institute, Izatnagar, UP on performing two way analysis of variance for two data sets.
- Dr. Prameela Krishnan, Head, Division Agricultural Physics, IARI on the use of SAS for doing PCA to generate minimum data sets (MDS) for computation of Crop Status Index (CSI).
- Ms. Sweta Amrita Lakra, Ph. D. Student, Division of Environmental Science, ICAR-IARI, New Delhi regarding analysis of data of Ph.D. research work entitled “Calibrating the info crop modeling for assessing impact of climate change”
- Ms. Sukanya Som, M.Sc. (Agril. Extension), ICAR-IARI, New Delhi regarding analysis of social science data employing nonparametric test and Dr. Madhubala Thakrey, Scientist (ICAR-IARI), New Delhi regarding analysis of RBD design.
- Dr. Suresh M. Nebapure, Scientist, Division of Agricultural Entomology, ICAR-IARI on the use of two way analysis of variance for data on Electroantennogram responses of Uzi fly against various compounds viz., terpenoides, green plant volatiles, aromatics, aliphatics and nitrogenous compounds.
- Dr. Madhubala Thakrey, Scientist, IARI, New Delhi to use RBD design.
- Mr. Anirban Mukhopadhay, Scientist, VPKAS, Almora to apply fuzzy logic.
- Dr. Heena Sharma, SRF in the project entitled “Regulatory role of gibberellic acid under high temperature stress in wheat (Triticum aestivum L.)” at IARI, New Delhi (funded by CSIR) on July 20, 2015.
- Ms.Vanita Pandey, Ph.D. student of PG School, IARI in the analysis of data on soybean.
- M.Sc. (Floriculture) student regarding the data analysis of her research work. The data pertained to study the effect of various bio-fertiliser doses on the growth of gladiolus genotypes. The data on various plant traits like plant height, corn length, corn weight etc. were generated by using RCBD and the analysis was performed in SAS (9.4).

- Mr. Harish Makhija, Ph.D. Student, PG School, ICAR-IARI, New Delhi analysis of data on stability analysis and GGE plot generated for the given data to genotype x environment interaction of variety development.
- Ph.D. student Mr. Ravishankar M Pardhi in Agricultural Economics for Institute of Agricultural Sciences, BHU regarding price forecast of potato using ARIMA, SARIMA cointegration and wavelets technique.
- Ms. Snigdharani Sahoo, M.Sc. student, OUAT, Bhubaneswar to forecast production of different cereal and pulses using ARIMA model.
- Dr. Namita Saha, Scientist, Centre for Environment Science and Climate Resilient Agriculture (CESCRA), ICAR-IARI, New Delhi, on the use of cluster analysis for studying microbial diversity analysis under organic farming system. The data was analysed using SAS 9.3 and on the use of factorial experiments to study the effect of climate change variables (six different combinations of elevated CO_2 and elevated temperature as different treatment combinations) on Quorum sensing mediated bacterial pathogenesis of soft rot in tomato. The experiment was conducted in National Phytotron Facility lab,ICAR- IARI, New Delhi.
- Mr. Amrit Lamichaney, Scientist IIPR, on the procedure of analysis using D^2 and Principal Component Analysis for his research. The analysis was carried out using SAS software
- Dr. Bipasa Sarkar from Agricultural Chemicals, IARI in analyzing the Effect of moisture, soil type and Blue Green Algae (BGA) on Degradation of tricyclazole.
- Dr. D Ramajayam, Senior Scientist (Fruit Science), ICAR-Indian Institute of Oil Palm Research, Pedavegi on the use of confounded factorial in a single replication for a 3^4 factorial experiment {with factors as varieties(V), Nitrogen(N), Phosphorus(P) and Potassium(K) each at three levels} in 33 plots per block. The design was obtained after confounding VNPK. This design allows estimation of all main effects, two factor interactions and three factor interactions. Two degrees of freedom of 4-factor interaction are confounded with blocks and remaining 14 df are treated as error degrees of freedom assuming the absence of 4-factor interaction. He was also suggested the SAS steps for analyzing the data generated from this design.
- Sh. A Maity, Scientist, ICAR-IGFRI, Jhansi to analyze the data for 24 varieties with 9 traits and calculate the character to character interaction, D-square, MANOVA, genotypic and phenotypic correlation, heritability, genetic advance and path analysis.
- Dr. Hemant Kumar, Scientist, ICAR-IIPR, Kanpur for analysis of multivariate data using cluster analysis and Ms. Archana Sanyal, Ph.D. Scholar, Division of Seed Science and Technology, ICAR-IARI, New Delhi, for multivariate analysis of ordinal data.
- Dr. Shailendra Jha, Scientist, Division of Genetics, ICAR-IARI, New Delhi to use α-design for comparing 270 genotypes in two replications with 27 blocks each of size 10. The layout of the design was also given. He also suggested Alpha designs with parameters v = 100, b = 20, r = 2, k = 10, AE = 0.9308, DE = 0.9698 to phenotype reference set of wheat germplasm for phosphorus use efficiency in low P soil and hydroponics to Ms. Soumya, M.Sc. student, Division of Genetics, ICAR-IARI, New Delhi. The layout was generated from Design Resources Server deployed at ICAR-IASRI web site (http://iasri.res.in/design/).
- Dr. Rahul Kumar, Assitant Professor, Eternal University, Himachal Pradesh for analyzing the data using R-software. RBD analysis was done for iron and zinc content by 20 varieties of wheat with three replications. Also, the linear logistic regression analysis was performed by taking zinc (iron) content at grain stage as dependent variable and zinc (iron) content at nine different stages of plants as independent variables. Further, trend of zinc (iron) content at different stages of plants was studied.
- Vijay Parjapati, Ph. D. student ICAR-IARI, New Delhi to analyze data using PCA.

10

RAC, Management Committee and IRC

Research Advisory Committee (RAC)

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

1. Dr. Bimal K Roy, Chairman
   Professor, Indian Statistical Institute,
   203 Barrackpore Trunk Road,
   Kolkata-700108 (West Bengal)
2. Dr. Rajeeva Karandikar, Member
   Director, Chennai Mathematical
   Institute, H 1, SIPCOT IT Park, Siruseri,
   Kelambakkam – 603103 (Tamil Nadu)
3. Dr. Saumyadipta Pyne, Member
   Professor, Public Health Foundation
   of India, Indian Institute of Public
   Health (IIPH), Plot No.1, ANV Arcade,
   Amar Cooperative Society, Kavuri Hills,
   Madhapur, Hyderabad – 500033.
4. Dr. Bal BPS Goel, Member
   Ex- Director, ICAR-IASRI, B-77,
   Naraina Vihar, New Delhi-110028
5. Dr. SD Sharma, Member
   Former Vice-Chancellor,
   Dev Sanskriti Vishwavidyalaya,
   Haridwar and Former Director, IASRI,
   D-15/02, SF (Second Floor),
   Presidency Floor, ARDEE City,
   Sector 52, Gurgaon - 122 011.
   (Haryana)
6. Shri GC Manna, Member
   Deputy Director General (ESD),
   Central Statistical Office,
   MOS& PI, Sardar Patel Bhawan,
   Sansad Marg, New Delhi - 110001
7. Dr. UC Sud, Member
   Director, ICAR-IASRI,
   Library Avenue, New Delhi-110 012
8. Assistant Director General (Engg.) Member
   Indian Council of Agricultural Research
   Krishi Anusandhan Bhavan - II, Pusa,
   New Delhi – 110 012
9. Dr. Seema Jaggi, Member-Secretary
   Principal Scientist and
   Officiating Head of Division
   (Design of Experiments),
   ICAR-IASRI, Library Avenue, Pusa,
   New Delhi-110 012

The 17th meeting of the Research Advisory Committee (RAC) of ICAR-IASRI was organized on March 15, 2016 under the Chairmanship of Professor Bimal K. Roy, Indian Statistical Institute, Kolkata. The meeting was attended by Prof. Saumyadipta Pyne, Professor, Public Health Foundation of India, Indian Institute of Public Health (IIPH), Hyderabad; Dr. SD Sharma, Former Director, ICAR-IASRI, New Delhi and Former Vice-Chancellor, Dev Sanskriti Vishwavidalaya, Haridwar; Dr. Bal BPS Goel, Former Director, ICAR-IASRI, New Delhi; Shri GC Manna, Deputy Director General (NAD), Central Statistical Office, MOS& PI, New Delhi; Dr. Kanchan K. Singh, ADG, Engineering Division, ICAR, New Delhi; Dr. UC Sud, Director, ICAR-IASRI, as members of RAC of the Institute and Dr. Seema Jaggi, Principal Scientist and Officiating Head of Division (Design of Experiments), ICAR-IASRI, New Delhi as Member Secretary RAC. Dr. VK Gupta, National Professor, ICAR; Dr. Prajneshu, Former Head, Statistical Genetics, ICAR-IASRI; Dr. Rajender Parsad, Shri SD Wahi, Dr. AK Gupta, Principal Scientists, ICAR-IASRI; and Dr. Ajit, Principal Scientist and PME Incharge, ICAR-IASRI;

Dr. KK Tyagi, Consultant, ICAR-IASRI and all Heads of Divisions, All Professors of ICAR-IASRI also attended the meeting as special invitees.

Dr. UC Sud welcomed the Chairman and other members and made the introductory remarks and briefed about the major achievements of the Institute including ranking of ICAR-IASRI among the top ten Institutes of the ICAR based on the number and quality of publications. The institute has one National Professor Scheme and one National Fellow Scheme of ICAR running in the Institute. The institute is maintaining a strong Data Centre and has initiated the efforts in developing ICAR Research Data Repository for Knowledge Management named as KRISHI-Knowledge Based Resources Information Systems Hub for Innovations in Agriculture. This initiative of ICAR-IASRI has been given place in the list of New Year's ICAR achievements by the Director General, ICAR. Scientists of the institute have brought laurels to the institute. Dr. Seema Jaggi has received the prestigious INSA Teachers Award 2015 and Dr. Arpan Bhowmik received the Dr. G.R. Seth Memorial Young Scientist Award from ISAS. The important publications of the Institute i.e. Annual Report 2014-15, Vision 2050, Databook 2015, Sankhyiki Vimarsh 2015 and 4 Newsletters were brought out during the year. Dr. Sud also informed the house that Dr. Tauqueer Ahmad has recently joined as Head of Division of Sample Surveys and Dr. Hukum Chandra was appointed as National Fellow of ICAR.

Dr. Ajit, Incharge, PME presented the broad research programmes, significant research achievements, future research programmes and other related activities of the Institute during the period January 01, 2015 to February 29, 2016. He presented the 86 research projects in which scientists of the Institute were involved during the period, out of which 08 were collaborative, 35 externally funded, 4 consultancy project, 1 National Professor Scheme of ICAR and 1 National Fellow Scheme of ICAR. He apprised the members regarding 15 completed research projects and 34 new projects undertaken during the period. The institute published its Annual Report: 2014-15, Agriculture Research Data Book 2015, Quarterly News Letters, Vision 2050 and Sankhyiki Vimarsh. 97 research papers were published in national/ international refereed journals. A number of popular articles, project reports, book, book chapters, training/e-manuals/e-resources, workshop document were also published. 05 databases were also developed. The scientists of the institute have participated in different conferences/ workshops and total 137 papers have been presented in these conferences.

The Institute has received 2 copyright from the Registrar, office of Copyrights, New Delhi for Web Generation of Experimental Designs Balanced for Indirect Effects of Treatments (granted on 15/07/2015, registration no-SW-8370/20135) and Pilot Study on Cost of Production of Coconut in Kerala (granted on 15/07/2015, registration no-L62123/2015). Also, Applied to the Registrar, Office of Copyrights, New Delhi for 7 copyrights for 4 Software on Pilot Study to Develop an Alternative Methodology for Estimation of Area and Production of Horticultural Crops, Sample Survey Resources Server, Web Generation of Factorial Experiments with Minimum Level Changes in Run Sequences (webFMC) and Web Generation of Polycross Designs (webPD) and 3 publications on Significance of Experimental Designs in Agricultural Research, Study to Investigate the Causes of Variation between Official and Trade Estimates of Cotton Production, Study to Develop an Alternative Methodology for Estimation of Cotton Production. It was informed that a sum of Rs. 85,44,814 was generated as revenue through sale of software packages, organizing customized trainings and consultancy projects in 2015.

Dr. Ajit highlighted the awards and recognitions won by the scientists of the Institute. One scientist received the INSA TEACHERS AWARD 2015 in the Meeting of the Academy held during December 28-30, 2015 at Indian Institute of Science, Education and Research (IISER), Bhopal, One Scientist was awarded Professor P.V. Sukhatme Gold Medal Award for outstanding contribution in the field of Agricultural Statistics during 68th Annual Conference of the Indian Society of Agricultural Statistics organized at ICAR-IASRI, New Delhi from January 29-31, 2015 and National Award in Statistics 2014-15 from the Ministry of Statistics and Programme Implementation, Government of India, on June 29, 2015, at Vigyan Bhawan, New Delhi. One scientist has been elected as Fellow of National Academy of Agricultural Sciences and Society of Genetics and Plant Breeding, one scientist received Dr. GR Seth Memorial Young Scientist Award in 69th Annual Conference of Indian Society of Agricultural Statistics (ISAS) at University of Kota, Kota, Rajasthan during December 14-16, 2015, one scientist received Active participation Award Women Member 2014-15 from Computer Society of India, Delhi Chapter in recognition of significant contribution to the CSI Chapter activities on 05 December 2015, one

scientist was awarded Gold Medal with Certificate of Academic Excellence in Graduation Ceremony, on 05 September, 2015 for having First Rank in First Batch as ICAR nominated and sponsored candidate in Post Graduate Diploma in Technology Management in Agriculture (PGDTMA), a joint course of ICAR-NAARM and Central University Hyderabad, two scientists received Young Scientist Award of the Society for Application of Statistics in Agriculture and Allied Sciences (SASAA) on March 03, 2016 at National Seminar on Recent Advances in Statistical Tools for Agriculture and Allied Sciences organized by Society for Application of Statistics in Agricultural and Allied Sciences (SASAA) in collaboration with Department of Agricultural Statistics, Bidhan Chadra Krishi Viswavidyalaya (BCKV), Mohanpur and Indian Institute of Science Education and Research (IISER), Kolkata during March 03-05, 2016. One Scientist received Individual Award as Distinguished Scientist Award in recognition of her meritorious and outstanding scientific contribution in the field of Bioinformatics, one scientist received Individual Award as Young Scientist Award in recognition of his outstanding scientific contribution in the field of Bioinformatics and jointly received Team Award as 3rd Prize for the research paper entitled "In silico gene prediction and their promoter analysis for the genes related to biotic stress in tomato (*Solanum lycopersicum*)" authored by Tandon, G, Jaiswal, S, Iquebal, MA, Singh, S, Rai, A and Kumar, D by the Society for Bioinformatics and Biological Sciences, Allahabad in the National Conference on Bioinformatics Panorama in Agriculture and Health (NCBPAH 2015) at SHIATS, Allahabad organized during October 05-06, 2015. In addition to this many scientists received best paper awards, recognitions and appreciation letters for their contribution at various conferences, symposia etc. Three scientists have served as FAO consultants.

Dr. Seema Jaggi, Incharge, Training Administration Cell presented the details of the training and teaching activities of ICAR-IASRI. It was informed that during the period two convocations i.e. 53rd and 54th Convocation of Post Graduate School ICAR-IARI were held on 20th February 2015 and 05th February 2016. In 53rd convocation, 5 Ph.D. (Agricultural Statistics), 6 M.Sc. (Agricultural Statistics), 2 M.Sc. (Computer Application) and 5 M.Sc. (Bioinformatics) students received degrees. Further, in 54th convocation, 3 Ph.D. (Agricultural Statistics), 8 M.Sc. (Agricultural Statistics), 8 M.Sc. (Computer Application) and 5 M.Sc. (Bioinformatics) students received degrees. Three students, One M.Sc. (Agricultural Statistics), one M.Sc. (Computer Application) and one M.Sc. (Bioinformatics) received the Nehru Memorial Gold Medal of ICAR-IASRI. One student was awarded for Best M.Sc. (Agricultural Statistics) Thesis 2015 by Society for Application of Statistics in Agriculture and Allied Sciences (SASAA), Department of Agricultural Statistics, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal on the topic Construction of Latin Hypercube Designs. The students are also actively participating in extra-curricular activities, like All India Inter Agricultural Universities Youth Festival.

It was also informed that some of the students are getting DST Inspire and UGC Fellowships. It was also informed that during the year, 672 researchers have been trained through various training programmes. A Senior Certificate Course in Agricultural Statistics and Computing was also conducted.

Dr. VK Gupta, ICAR National Professor apprised the RAC about the research activities of the National Professor Scheme. Dr. Gupta informed that a book entitled "*Statistical Analysis of Agricultural Experiments*" (VK Gupta, Rajender Parsad, Lal Mohan Bhar and Baidya Nath Mandal) has been published. The book has 12 Chapters, 4 Annexures and a bibliography and runs into 400 pages. Two more important publications brought out are (i) monograph entitled "*Weighting and Calibration in Sample Survey Estimation*" (VK Gupta, UC Sud and Chandra Bhanu Chauhan), and (ii) "*Significance of Experimental Designs in Agricultural Research*" (VK Gupta, Rajender Parsad and Baidya Nath Mandal).

An interesting article on "*History of Statistics on Timeline*" (VK Gupta, Baidya Nath Mandal and Rajender Parsad) has been written and hosted at Sample Survey Resources Server (http://sample.iasri.res.in/ssrs/). The web resource has also been populated with a bibliography on "*Non-response in Survey Sampling*", which contains 484 references. The web resource has also been populated with a mobile (Android) App called "*Mobile Assisted Personal Interview* (MAPI)." MAPI has been developed to collect the data for crop area, yield, production and other demographic and social information of the area under consideration. The questionnaires are developed in ICAR-IASRI as per the requirement of the project. For other customized surveys the developed software can be modified based on the request of the user. For access to the collected data, MS Excel file can be generated directly from the software and can be accessed from the phone memory or can be uploaded to any kind of cloud storage (i.e. drop box, google drive, etc.). For security, data users have to register themselves with

the software before using it. The registration can be done using a valid email id. This feature maintains the confidentiality of the data. Further, to verify the actual data collection event, a provision has been made in the questionnaire to record the GPS location and snapshot of the field where the survey is actually done. Likewise, there are many features in this software which improve the quality of the data.

Dr. Gupta also informed that he would retire in the afternoon of 16 March 2016 after attaining the age of 65 years. So it would not be out of place to summarize the achievements made during the last 10 years (April 2006 till March 2016), the duration of the National Professor Scheme, in a tabular form. The same are given below:

Research papers published in refereed journals	58
Books published	02
Monographs published	05
Book chapters published	07
Reviews of books / monographs appeared	03
Technical / popular articles published	06
Workshop proceedings	01
Projects handled other than the project of the national professor scheme	14
Special issues of journals brought out as guest editor / chair editor	10
Copyrights obtained	03
Web portals developed and strengthened for dissemination	02
Other websites developed and strengthened	02
Awards ~ Sankhyiki Bhushan title from Indian Society of Agricultural Statistics	
Elected member of the International Statistical Institute, Netherlands	
Elected fellow of the National Academy of Agricultural Sciences and Indian Society of Agricultural Statistics	
Editor, National Academy of Agricultural Sciences	
Chair editor, Journal of the Indian Society of Agricultural Statistics (2009 – 2015)	
President, Society of Statistics, Computer and Applications	
President, governing body, Institute of Applied Statistics and Development Studies	

The members appreciated the efforts made and were satisfied with the co-ordination between ICAR National Professor Research Unit and the Institute.

Dr. UC Sud apprised the RAC about the research activities of the National Fellow Scheme entitled 'Robust and Efficient Small Area Estimation Methods for Agricultural and Socio-economic Surveys and Their Application in Indo-Gangetic Plain', in absence of Dr. Hukum Chandra as he was on official visit to Indonesia in connection with FAO Consultancy project. The summary of presentation is as follows:

There is a growing need for current and reliable count data at small domain or small area level. The empirical predictor under a generalized linear mixed model (GLMM) is often used for small area estimation of such data. However, GLMM assumes that the fixed effect parameters are spatially invariant and do not account for the presence of spatial nonstationarity in the data. The geographically weighted regression concept has been considered to extend the area level version of GLMM to take into account spatial nonstationary and then to use it in small area estimation. In particular, the empirical predictor for small areas under a spatial nonstationary version area level GLMM (NSEP) is proposed. Two approaches have been developed for estimating mean squared error for the NSEP, an analytical MSE and a parametric bootstrap approach. A parametric bootstrap approach based diagnostic procedure for presence of spatial nonstationarity in the count data is also developed. The empirical results based on simulation studies show that the proposed NSEP provides efficient estimates for small areas as compared to existing methods when spatial nonstationarity is present in the data. Developed MSE estimators provide satisfactory performance. In particular, analytical MSE estimator has smaller bias but bootstrap MSE estimator is slightly more stable. Proposed small area estimation method is also applied to obtain reliable estimates of proportion of poor households at district level in the State of Uttar Pradesh by using survey data from the Household Consumer Expenditure (HCE) Survey 2011-12 of National Sample Survey Office (NSSO) 68th round and the Population Census 2011. Subsequently, a poverty map for State of Uttar Pradesh is produced which provides an important information for analysis of spatial distribution of poverty in the state.

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

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

After discussions, the following action points emerged:

1. The scientists of the institute have developed a number of databases, tools, systems and online resources. The impact or usage over time of these publicly available tools and databases may be evaluated.
2. Some studies could be taken up by ICAR-IASRI regarding development of survey methodologies for improving official statistics and obtaining estimates at districts level, which could be highly beneficial in research data analysis.
3. The institute must initiate research programmes to study the ground water contamination affecting the agriculture productivity.
4. Research opportunities may be explored in Big Data approaches for agricultural surveillance and real-time analytics projects with the possible help of DST Big Data Initiative and the National Supercomputing Mission.
5. Interaction opportunities may be explored with national/ international labs working on cutting-edge areas such as Climate Change, Genome Editing and Metagenomics.
6. A number of inputs are going into the soil. Studies may be taken up for evaluating soil health based on secondary data.
7. The institute must work in an inter-disciplinary approach. Collaborative inter-disciplinary studies may be initiated with other institutes in India and elsewhere specializing in diverse upcoming fields of study. Division of Statistical Genetics may take collaborative studies with institutes like National Institute of Biomedicine Engineering.
8. The online services and web resources developed on design of experiments, sample surveys, bioinformatics and experts systems may be strengthened.
9. Vacant scientific positions at ICAR-IASRI should be filled on priority basis and for this the concerned authorities may be approached.

Institute Management Committee (IMC)

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

1. Dr. UC Sud — Chairman (Ex-Officio)
   Director, ICAR-IASRI, Pusa,
   New Delhi-110 012
2. Joint Director (Research) — Member
   ICAR-IARI, Pusa,
   New Delhi-110 012
3. Director of Agriculture — Member
   Government of Delhi, ITO,
   New Delhi-110001
4. Dr. (Smt.) Ravinder Kaur — Member
   Director (A), ICAR-IARI and
   Project Director,
   Water Technology Centre,
   ICAR-IARI, Pusa, New Delhi -110 012
5. Dr. Suresh Pal — Member
   Head, Division of Agricultural
   Economics, ICAR-IARI, Pusa,
   New Delhi -110 012
6. Dr. Niranjan Prasad — Member
   Head, Division of Processing and
   Product Development,
   ICAR-IINRG, Ranchi
7. Dr. C.R. Mehta — Member
   Project Coordinator,
   ICAR-AICRP on FIM,
   ICAR-CIAE, Bhopal
8. Finance & Accounts Officer — Member
   ICAR-IARI, Pusa,
   New Delhi-110 012
9. Head of Office — Member Secretary
   ICAR-IASRI, (Ex-Officio)
   Pusa, New Delhi-110 012

64th meeting of IMC was organized at ICAR-IASRI on August 01, 2015. At the outset, Dr. UC Sud, Director, ICAR-IASRI, New Delhi and the Chairman of the Management Committee welcomed all the distinguished members and special invitees present in the meeting. Dr. Ajit, In charge PME Cell made presentation on research and other related activities of the institute. He also presented the achievements of completed as well as ongoing research projects of the institute. Dr. Seema Jaggi, Officiating Head (DE) and Incharge, Training Administration Cell made presentation on Teaching and Training Activities of the Institute. Further, procurement of equipment for the financial Year 2015-16 of XII plan (Equipment) and Budget estimate for the year 2015-16 and

Actual Expenditure incurred up to March 31, 2015 in respect of Plan/ Non-Plan of the Institute and reconstitution of the Institute Grievance Committee were presented before the committee.

Institute Research Committee (IRC)

The Institute Research Committee (IRC) is an important forum to guide the scientists in the formulation of new research projects and to review the progress of on-going research projects periodically. It also monitors the follow up action on the recommendations of the Quinquennial Review Team (QRT), Research Advisory Committee (RAC) in respect of technical programmes of the Institute. Director, ICAR-IASRI is the Chairman and In-charge (PME Cell) is the Member Secretary of the IRC. During the entire year, 33 new research projects were approved and progress of 106 on-going research projects was reviewed and 16 research projects were declared complete and 01 project was declared as closed.

Two meetings (83rd and 84th) of the IRC were held during September 21-22, 2015 and April 05-06, 2016 respectively.

- In the 83rd meeting, 24 new research projects (08 Institute funded, 01 in collaboration with other Institutes and 15 outside funded) were approved and progress of 44 on-going research projects (22 Institute funded, 05 in collaboration with other Institutes and 17 outside funded) were discussed and 06 research projects were declared as complete.
- In the 84th meeting, 09 new research projects (04 Institute funded, 03 outside funded and 02 Extramural funded) were approved and progress of 62 on-going research projects (26 Institute funded, 05 in collaboration with other Institute and 31 outside funded) was reviewed and 10 research projects were declared as complete and 01 project was declared as closed.

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

PAPERS PRESENTED

- Review Workshop of Network Analysis Project on Market Intelligence at BHU, Varanasi during 07-08 May 2015.
  - Paul, RK. Co-integration Analysis. (Invited talk).
- International Conference on Agriculture, Food Engineering and Environmental Sciences-Sustainable Approaches (AFESA-2015) organized by "Krishi Sanskriti" at Jawaharlal Nehru University, New Delhi during 09-10 May 2015.
  - Grover, M*, Angadi, UB and Sharma, N. Development of models for discovery of novel proteins associated with photosynthesis using machine learning approaches.
- XXXIII Group meeting of AICRP on Vegetable Crops organized at IIVR, Varanasi during May 21-24, 2015.
  - Parsad, R*, Dhandapani, A and Dash, S. Information system for planning and analysis of experiments of AICRP on vegetable crops.
- International Conference on Recent Advances in Mathematics, Statistics and Computer Science organized by the Central University of South Bihar (CUB), Patna held during 29-31 May 2015 at ICAR Research Complex for Eastern Region, Patna.
  - Ahmad, T*, Sud, UC and Sahoo, PM. Status of horticulture statistics in India: A new methodological initiative. (Invited talk).
  - Rathod, S. An improved auto regressive fractionally integrated moving average (ARFIMA) model using artificial neural network (ANN) to forecast spot prices of mustard.
  - Kumar, P. Rank based stability measures for assessing stability of crop varieties.
- 9th Statistics Day organized by Ministry of Statistics and Programme Implementation, Govt. of India at Vigyan Bhavan, New Delhi on 29 June 2015.
  - Chandra, H. Some innovative approaches for small area estimation.(Invited talk).
- 60th International Statistics Institute World Statistics Congress 2015 held at Rio De Janeiro, Brazil during 26-31 July 2015.
  - Chandra, H*, Salvati, N and Chambers, R. Small area prediction for discrete data under spatial nonstationary model. (Invited paper).
- Altair Technology Conference ATCx 2015 held at Le Meridien, New Delhi on July 17, 2015.
  - Rai, Anil, Chaturvedi, KK*, Lal, SB, Anagadi, UB and Jai Bhagwan. CABGRID: Interactive job submission and management portal for Indian agriculture. (Invited talk).
- First Workshop of Nodal Officers of ICAR Research Data Repository for Knowledge Management initiative during 04-05 August 2015 at NASC Complex, New Delhi.
  - Jaggi, Seema* and Sarkar, Susheel Kumar. Information system on designed experiments. (in the technical session IV on Unit Level Data Repository). (Talk).
- International Conference on Recent Trends in Computer and Information Technology Research at BSAITM, Faridabad during 25-26 September 2015.
  - Singh, Arti, Sharma, Anu, Dey, Nilanjan and Ashour, Amira S. Web Recommendation Techniques–Status, Issues and Challenges.

- National Conference on Bioinformatics Panorama in Agriculture and Health (NCBPAH 2015) at SHIATS, Allahabad during 05-06 October 2015.
  - Kumar, Dinesh. Global status of agricultural bioinformatics: Challenges and issues.
  - Gautam, Aditi, Sharma, Asuda, Sarika, Fatma, Samar, Arora, Vasu, Iquebal, MA*, Nandi, S, Sundaray, JK, Jayasnakar, P, Rai, Anil and Kumar, Dinesh. Development of Antimicrobial Peptide Prediction tool for aquaculture industries.
- 6th World Congress on Biotechnology organized at New Delhi during 05-07 October 2015.
  - Meher, PK. A hybrid approach for identifying 5' splicing junction with higher accuracy.
  - Das, S. Gene selection and co-expression module detection common to various abiotic stress responses in Rice and Arabidopsis.
- 29th Annual conference of Indian Society of Agricultural Marketing held at Department of Agricultural Economics & Management, Rajasthan College of Agriculture MPUAT, Udaipur on 28-30 October 2015.
  - Bhardwaj, SP. Price forecast an instrument for Improvement in Agricultural Production and Marketing in Rajasthan- A case study of Rape & Mustard seeds.
- International Conference on Statistics and Related Areas for Equity Sustainability and Development held at University of Lucknow, Lucknow during 28-30 November 2015.
  - Alam, Wasi. Hybrid univariate time series approach for forecasting rice yield.
- 23rd Annual Conference of Agricultural Economics Research Association held at CIFE, Mumbai during 02-04 December 2015.
  - Paul, RK*, Saxena, R, Chaurasia, S, Zeeshan and Rana, S. Examining export volatility, structural breaks in price volatility and linkages between domestic and export prices of onion in India.
  - Ray, Mrinmoy . Quantifying the impact of climate change of Kharif Rice yield in India employing ARIMA-Intervention model.
- 50th Golden Jubilee Annual Convention on "Digital Life" of Computer Society of India (CSI) 2015 held at Bharthi Vidyapeeth, New Delhi during 02-05 December 2015.
  - Chaturvedi, KK*, Khatri, S, Sharma, M, Srivastava, RC and Singh, VB. Mining software engineering repositories: Issues and challenges.
  - Deb, Chandan Kumar, Sudeep*, Arora, Alka and Das, Madhurima. A framework for ontology learning from taxonomic data.
  - Singh Aarti* and Sharma, Anu. A Multi-Agent Framework for Context Aware Dynamic User Profiling for Web Personalization.
- Seventh International Workshop on Big Data Benchmarking held at India Habitat Centre, New Delhi during 14-15 December 2015.
  - Chaturvedi, KK,* Rai, A, Farooqi, MS, Lal, SB and Angadi, UB. Big Data Initiatives in Agricultural Bioinformatics.
  - Parsad, Rajender, Dhandapani, A*, Obi Reddy, GP, Sehgal, VK, Kumar, Mukesh and Choubey, AK. ICAR research data repository for knowledge management.
- 69th Annual Conference of Indian Society of Agricultural Statistics, New Delhi held at University of Kota, Kota, Rajasthan during 14-16 December 2015.
  - Angadi, UB. Feed informatics: Application information technology on animal feed resources.
  - Bhardwaj, SP*, Gurung, Bishal and Singh, KN. Study of market behaviour and price transmission in agricultural commodities.
  - Bhowmik, Arpan*, Varghese, Eldho, Jaggi, Seema and Varghese, Cini. Factorial Experiments with Minimum Changes in Run Sequences.
  - Chandra, H. Estimation of poverty and social exclusion indicators at small area level.
  - Choubey, AK. New Challenges in the field of bioinformatics.
  - Gupta, AK*, Sud, UC, Chandra, Hukum, Ahmad, Tauqueer, Sahoo, Prachi Misra, Aditya, Kaustav and Biswas, Ankur. Estimation of seed, feed and wastage ratios of major food grains crops.
  - Gurung, Bishal* and Singh, KN. Modeling and simulation aspect of technology forecasting.
  - Gurung, Bishal* and Singh, KN. Estimating hedge ratio using time varying approach. (Invited Talk).
  - Jaggi, Seema. Challenges in training and post graduate teaching in agricultural statistics.
  - Kumar, Mukesh*, Bhardwaj, Anshu, Arora, Alka, Marwaha, Sudeep, Rao, N. Srinivasa, Islam, SN, Ahuja, Sangeeta and Choubey, AK. Implementation of supply chain management in ICAR.
  - Kumar, Prakash*, Lal, Krishan, Parsad, Rajender and Gupta, VK. Construction of

confounded asymmetrical factorial nested row column designs.

- Lal, SB. Using mobile cloud computing in agriculture.
- Mandal, BN*, Gupta, VK and Parsad, Rajender. Algorithmic construction of A-optimal balanced treatment incomplete block designs.
- Mandal, BN. L1 regularized multiplicative iterative path algorithm for non-negative generalized linear models.
- Paul, RK* and Bhatt, S (2015). Crop insurance and its impact on farm output; A household level analysis in India (Invited talk).
- Paul, RK. Long memory stochastic volatility model: An application.
- Rao, AR. Agri-informatics.
- Rao, NS, Marwaha, Sudeep, Ravisankar, H.and Sivaraju, K. Knowledge base and disease identification system in tobacco.
- Ray, Mrinmoy, Rai, Anil, Singh, KN, V, Ramasubramanian, Kumar, Amrender and Rathod, Santosh. A novel approach to technology forecasting using time series intervention based trend impact analysis.
- Sinha, Kanchan* and Gurung, Bishal. An approach to assess price volatility spillover in Indian onion markets.
- Sud, UC and Gupta, VK. Determination of optimum sample size for crop yield estimation at GP level.
- Sud, UC and Gupta, VK. On the calibration approach in sample survey estimation.

- 35th Annual Convention International Conference of Indian Society for Probability and Statistics (ISPS), held at University of Lucknow during 28-30 November 2015.
  - Alam, W, Sinha, K, Rathod, S, Singh, KN. Hybrid Univariate Time Series Approach for Forecasting Rice Yield.
- International Indian Statistical Association Conference 2015 (IISA 2015) at Pune during 20-22 December 2015.
  - Chandra, H, Salvati, N and Chambers, R. Small Area Estimation for Discrete Data under Area Level Spatial Models. (As invited paper).
- International Indian Statistical Association Conference on Celebrating Statistical Innovation and Impact in a World of Big & Small Data jointly organized at Yashwantrao Chavan Academy of Development Administration (YASHADA) Pune, Maharashtra by Department of Statistics, Savitribai Phule Pune University during 20-24 December 2015:
  - Chandra, H*, Salvati, N and Chambers, R. Small area estimation for discrete data under area level spatial models (Invited Talk).
  - Varghese, Cini*, Kumar, Arvind, Varghese, Eldho and Jaggi, Seema. Statistical designs under three-way blocking structure where experimental units form clumps.
- 9th International Triennial Calcutta Symposium on Probability and Statistics organized by Department of Statistics, University of Calcutta during 28-31 December 2015.
  - Bhowmik, Arpan*, Varghese, Eldho, Jaggi, Seema and Varghese, Cini. Symmetric factorial experiments with minimally changed run sequences.
  - Mandal, BN, Parsad, Rajender* and Gupta, VK. Construction of incomplete block designs through integer programming. (Invited talk delivered on 29.12.2015).
  - Pal, Soumen. Neural network auto-regression approach for modeling and forecasting of monthly rainfall volume during monsoon.
  - Paul, RK. Long memory in maximum and minimum temperature se.
- 8th GCRA international conference on Innovative Digital Applications for Sustainable Development at University of Agricultural Science, Bengaluru during 05-07 January 2016.
  - Devi, Lethe and Angadi, UB. “FeedAsist” an expert system for computing least cost balance ration.
- Workshop-cum-Training programme on “Bioinformatics Techniques for Agricultural Data Analysis” funded by Department of Biotechnology (DBT) and organized at Agricultural Knowledge Management Unit, ICAR-Indian Agricultural Research Institute, PUSA, New Delhi from 11-13 January 2016.
  - Rao, AR. Some recent developments in Agricultural Bioinformatics. (Invited talk)
  - Iquebal, MA. Tools for SSR mining and its application in variety/breed identification. (Invited lecture).
- National Seminar on Plant Genomics and Biotechnology: Challenges and Opportunities in 21st century held at OUAT, Bhubaneswar, Odisha during 23-24 January 2016.
  - Das, Samrendra*. Differential gene co-expression network analysis for identification of hub genes and gene modules associated

with salinity stress response in rice. (presented in Young Scientist Forum on 23 January 2016).

- Second International Conference on Genomics in Aquaculture (ISGA-II-2016) held in collaboration with Association of Aquaculturist and Asian Fisheries Society, Indian Branch at ICAR- Cantal Institute of Freshwater Aquaculture (CIFA), Bhubaneshwar, Odisha during 28-30 January 2016.
  - Kumar, Dinesh*. Phenomics for GWAS in domestic animals: Relevance in aquaculture. (Invited lecture).
  - Iquebal, MA*, Nandi, S, Jasrotia, RS, Jaiswal, S, Routray, P, Rai, A, Kumar, D, Sundaray, JK and Jayasankar, P. Computational prediction of putative miRNA controlling reproductive genes in rohu (Labeo rohita Hamilton). (oral presentation).
- International Conference on Innovative Research in Biotechnology, Biomedical Sciences, Bioinformatics and Stem Cell Applications (BSC-2016) organised by Krishi Sanskriti at Jawahar Lal Nehru University, New Delhi on 30 January 2016.
  - Sarika*, Vasu Arora, Anil Rai, Dinesh Kumar. MultiProt: a web based computational tool for protein parameters (Oral Presentation)
- International Conference on Translational Biotechnology at Motilal Nehru National Institute of Technology, Allahabad during 04-06 February 2016.
  - Singh, Indra, Mishra, DC, Kumar Sanjeev and Rai, Anil. Single Nucleotide Polymorphisms in miRNA binding site alters its structure and function.
  - Mishra, DC, Mittal, Shikha, Singh, Indra, Kumar, Sanjeev and Rai, Anil. Identification of co-regulated genes of chick pea under abiotic stress.
  - Majumdar, PG, Niyati, Rai, Mishra, DC, Kumar, Sanjeev, Rai, Anil, Chaturvedi, KK, Lal, SB, Kumar, Anil, Archak, Sunil and Farooqi, Mohammad Samir. Genome Analysis of Rhizobium Species using Codon Usage Bias Tools.
  - Nigam Deepti, Kadimi, Puneet Kumar, Kumar, Sanjeev, Mishra, DC, Singh, Manoj Kumar, Rai, Anil, and Sinha, Subodh Kumar. Meta-analysis of potential miRNA in Triticum astivum reveals their genome biased association with different metabolisms.
- National Conference on Agro technology, Commerce and Sustainable Use of Medicinal and Aromatic Plants at NASC Complex, New Delhi during 06-07 February 2016.
  - Rao, NS. ICT application in medicinal and aromatic plants: Current status and future challenges. (invited talk).
- National Workshop on Current Trends in Agricultural Bioinformatics at ICAR-NAARM, Hyderabad during 15-17 February 2016.
  - Rao, AR. Agricultural bioinformatics: Few case studies and my experience. (Invited Talk).
- 18th Annual Conference of Society of Statistics Computer and Applications (SSCA) on Significance of Statistics as Interdisciplinary Sciences organized at Department of Statistics, University of Jammu, Jammu during 18-20 February 2016.
  - Aditya, Kaustav*, Sud, UC and Chandra, Hukum. District level crop yield estimation under spatial small area model.
  - Arora, Alka*, Sudeep, Rao, AR, Wahi, SD, Chinnusamy, Viswwanthan and Jain, Prachi. Multimedia data management system for Agricultural experiments.
  - Bharadwaj, Anshu* and Jain, Rajni. E learning in agricultural education: Current situation and future challenges. (invited talk)
  - Bharadwaj, Anshu. Supply chain management in ICAR: Issues and Challenges. (invited talk)
  - Das, Samrendra*, Rai, Anil, Meher, Prabina Kumar and Bhar, Lal Mohan. Gene selection, module and hub gene detection for gene co-expression network analysis and application to aluminium stress in soybean. (For Dr.MN Das Young Scientist Award and also awarded as runner up and got appreciation certificate for this).
  - Grover, M. Quantum computing: A tool to handle big data in biological systems.
  - Gurung, Bishal* and Singh, KN. A Markov chain approach to study the dynamics of area substitution of edible oilseeds in India.
  - Kumar*, Mukesh, Choubey, AK, Parsad, Rajender, Bhardwaj, Anshu, Dhandapai, A, Obi Reddy, GP, Sehgal, VK and Chand, Subhash. Information flow process for agricultural research data repositories web portal (Invited Talk).
  - Kumar, Raju* and Bhar, LM. Outliers in incomplete multi response experiment.
  - Kumari, Vandita*, Sud, UC and Aditya, Kaustav. Calibration approach based regression analysis.

- Lal, SB. Cloud infrastructure for on-demand bioinformatics computing. (invited talk)
- Mishra, DC. Genome assembly: A big data perspective. (invited talk)
- Paul, RK. Statistical models for forecasting volatile crop yield data. (invited talk)
- Rao, NS* and Choubey, AK. Agricultural expert systems: Current status and future challenges. (invited talk)
- Rathod, S*, Singh, KN, Alam, MW, Ray, M. ARIMA - Genetic Algorithm approach for forecasting of maize yield.
- Sinha, K* and Gurung, Bishal. Identification of price transmission using threshold cointegration approach.

- 19th ADNAT Convention International Symposium on Microbiome in Health and Disease at NIANP, Bangalore during 23-25 February 2016.
  - Bagath M, Kolte, Atul, Angadi, UB, Grover, Monendra, Sejian, V and Bhatta, Raghavendra. Development of 16s rDNA rumen specific microbes database.
- International Conference on Bioinformatics and Systems Biology at IIIT, Allahabad during 04-06 March 2016.
  - Kumar, S, Bansal, KC, Chinusamy, V, Sarika, S and Rao, AR. Genome-wide identification and analysis of abiotic stress responsive transcription factor and MIR genes in bread wheat (Triticum aestivum L.).
  - Rao, AR. Random Forest and its applications in genomics: Few case studies. (Invited Talk)
- 10th INDIACom; INDIACom-2016; IEEE Conference ID: 37465 3rd 2016 International Conference on "Computing for Sustainable Global Development", 16–18 March 2016 Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi (INDIA).
  - Kumar, M, Gupta, A, Amrapali, S, Agrawal, PK, Mahajan, V, Kant, L and Bisht, JK, eResource for DUS Characterization of Maize Varieties and Inbreds.
  - Bharadwaj, A, Roychoudhury, I, Islam, SN, Chaturvedi, KK, Sahoo, PM, R.K.Paul. Interpolating Climate Data using wTICD: A web based tool.
- International Conference on 'Innovative Research in Agriculture, Food Technology, Physical, Chemical Sciences, Ecological, Mathematical/Statistical Applications for Sustainable Development held at Jwahar Lal Nehru University, New Delhi on 13 March 2016.
  - Alam, W*, Sinha, K, Roy, M, Rathod, S and Arya, P. Artificial neural network approach for forecasting nonlinear components of linear time series models.

INVITED LECTURES DELIVERED

Dr. UC Sud

- A lecture on Use of various sampling techniques and their applications in Agricultural Surveys during Workshop on Research Methodology for Science Research Scholars/College and University Teachers of University of Kashmir held at UGC-Human Resource Development Centre, University of Kashmir, Hazartbal, Srinagar during 25-31 August, 2015.

Dr. Anil Rai

- A lecture on Bioinformatics and its applications in agriculture during Summer School on "Analytical Techniques for Decision Making in Agriculture" held at ICAR-National Institute of Agricultural Economics and Policy Research (NIAP) during 16 July- 05 August 2015.
- A lecture on Research methodology during Executive training program entitled "Applied Statistics for Coffee Research and Development" at Indian Institute of Plantation Management, Bangalore on 28 December 2015. (Invited lecture).
- A Lecture on " Activities of Agricultural Bioinformatics and Computational Biology in ICAR-IASRI" to the Participants of FOCARS on 22 September 2015 in ICAR-NAARM Hyderabad.

Dr. Tauqueer Ahmad

- A lecture on Area estimation under agroforestry using remote sensing and GIS during Training Programme on Role of Agroforestry in Increasing Tree Cover for the IFS Officers held at the Amity University, Noida during 16-20 November 2015.

Dr. Seema Jaggi

- Two lectures on i) Testing of hypothesis and ii) Testing of hypothesis using SPSS during Training Programme on Research and Technology, Statistical Analysis and Use of SPSS for Analyzing Statistical Data at Jagannath International Management School (JIMS), Vasant Kunj, New Delhi on 18 December 2015.
- A lecture on Statistical techniques for analysis of gender desegregated data during CAFT training programme on Gender Analysis and Mainstreaming in Agriculture organized by

Division of Agricultural Extension, ICAR-IARI, New Delhi from 02-22 January 2016.

Dr. Hukum Chandra

- A lecture on Various elementary concepts of sample surveys during Summer School on "Analytical Techniques for Decision Making in Agriculture" held at ICAR-National Institute of Agricultural Economics and Policy Research (NIAP) during 16 July - 05 August 2015.
- Two lectures on Data management and statistical computing using R software during Winter School on Advanced Tools and Techniques for Precise Input Application System organized at CIAE, Bhopal during 05-25 January 2016.
- Two lectures on An Overview of R during CAFT training programme on "Quantitative Techniques for Agricultural Policy Research" at Division of Agricultural Economics ICAR-IARI, New Delhi during 18 February - 09 March 2016.
- A lecture on System of Agricultural Statistics in India and its challenges- Challenges faced and scope of research. (2 lectures on February 24, 2016.) during Training for Trainers (ToT) course on "Official Statistics" organized by the National Statistical Systems Training Academy (NSSTA), CSO, Noida during 22-26 February 2016.

Dr. Rajender Parsad

- Two lectures on SAS: An overview during Summer School on "Analytical Techniques for Decision Making in Agriculture" held at ICAR-National Institute of Agricultural Economics and Policy Research (NIAP) during July 16 – August 05, 2015.
- Four lectures on Fundamentals of Design of Experiments and Web Resources on Designed Experiments during Workshop on Research Methodology for Science Research Scholars/ College and University Teachers of University of Kashmir held at UGC-Human Resource Development Centre, University of Kashmir, Hazartbal, Srinagar during 25-31 August, 2015.
- Six lectures on (i) Fundamentals of Design of Experiments; (ii) Augmented Designs; (iii) Analysis of Covariance; (iv) Diagnostics and Remedial Measures; (v) Design Resources Server and (vi) Indian NARS Statical Computing Portal during Training Programme on Laying out Quality Experiments/Field Trials of Rapeseed-Mustrad for Precise Evaluation under Different Conditions held at Directorate of Rapeseed-Mustard Research, Sewar, Bharatpur during 14-15 September 2015.
- Two lectures on (i) Advancement in statistical tools and techniques for effective data analysis and (ii) Web resources on experimental designs including Indian NARS Statistical Computing portal during Training Programme on Tillage and Nutrient Dynamics for Better Crop Production held under the aegis of Centre of Advanced Faculty Training, Department of Agronomy, Pantnagar during 10-30 October 2015.
- Two lectures on (i) Basics of SAS and descriptive statistics using SAS and (ii) Tests of significance and analysis of variance using SAS during Training Programme on SAS for Statistical Procedures on 17 October 2015 at ICAR-IARI, New Delhi.
- A lecture on Design and analysis of diallel cross experiments during Training Programme on Quantitative Techniques for Analysis of Breeding Experiments held at National Acaedmy of Agricultural Research Management, Hyderabad during 02-07 November 2015. (Invited lecture delivered through google hangouts)
- A lecture on Design Resources Server and other web resources on statistical sciences during SAARC Regional Training on Smart Practices for Climate Resilient Agriculture: Agroforestry Options organized by ICAR, IFPRI and SAC at New Delhi during 16-20 November 2015.
- A lecture on Design Resources Server and Indian NARS Statistical Computing Portal during Training Programme on SAS for Statistical Procedures at Agricultural Economics, ICAR-IARI, New Delhi on 28 November 2015.
- A lecture on SAS : An Overview (02 invited lectures were delivered on February 24, 2016) during CAFT training programme on "Quantitative Techniques for Agricultural Policy Research" at Division of Agricultural Economics ICAR-IARI, New Delhi during 18 February - 09 March 2016.
- A lecture on ICAR Research Data Management Policy and ICAR Research Data Repository for Knowledge Management during Workshop on 'ICAR-KRISHI Geoportal' for experts organized at ICAR-NBSS&LUP, Nagpur during 11-12 March 2016.
- A lecture on ICAR Research Data Management Policy and ICAR Research Data Repository for Knowledge Management during Workshop on 'ICAR-KRISHI Geoportal' for users organized at

ICAR-NBSS&LUP, Nagpur during 28-30 March 2016 and ICAR-NAARM, Hyderabad during 29-30 March 2016.

Dr. Dinesh Kumar

- Dr. Dinesh Kumar: Importance of Biological Science with multi-disciplinary research and career opportunities in 21st Century at Sanatan Dharama College (Lahore), Ambala Cantt, Affiliated College of Kurukshetra University, Haryana, on 03 September 2015.
- A Lecture on Lectures and Hands on sessions on Allele mining for identifying novel variants during Summer School on "Novel genomic tools and modern breeding approaches for enhancing productivity and nutritional quality of pulse crops" at ICAR-IIPR, Kanpur from 05-25 September 2015.
- Three lectures on i) Molecular marker discovery, ii) Genome annotation and iii) Metagenome analysis during Training-cum-Workshop on Biological Data Analysis through Computational Approach organized at CSIR-North East Institute of Science and Technology, Jorhat, Assam during 08-10 December 2015. (lectures and hands-on training).
- A Lecture and conducted hands-on session on Genome Annotation during National Workshop on "Bioinormatics-based Genomic and Proteomic Data Analysis in Microbial Domain" during 04-09 March 2016.

Dr. Sudeep

- A lecture on Project monitoring through FMS-MIS and HYPM in training programme on Management Developing Programme on Priority Setting, Monitoring and Evaluation (PME) organized at NAARM Hyderabad during 02-06 June 2015.
- A lecture on Online Decision Support System and b) Expert System in Agriculture during Training programme on Website Management and Online Reporting at Rajmata Vijayraje Scindia Krishi Vishwa Vidyalaya, Gwalior, M.P. on during 15-16 January 2016.

Dr. Prachi Misra Sahoo

- Two lectures on Overview & Applications of GIS during Summer School on "Analytical Techniques for Decision Making in Agriculture" held at ICAR-National Institute of Agricultural Economics and Policy Research (NIAP) during 16 July - 05 August 2015.
- A lecture on Hill area crop assessment during FAO sponsored Study tour on Use of Remote Sensing Technology for Producing Better Quality Crop Statistics for the officials of Ministry of Agriculture, Irrigation and Livestock (MAIL), Afghanistan held at Mahalonobis National Crop Forecasting Centre (MNCFC), Govt. of India, Ministry of Agriculture & Cooperation during 26-31 October 2015.
- Two lectures on i) Fundamentals of geographic information system and ii) Statistics for spatial data analysis during Training Programme on Geo-informatics in Natural Resource Management and Climate Change Mitigation held at ICAR-Indian Institute of Soil Science, Bhopal during 20-29 November 2015.

Dr. Cini Varghese

- Two lectures on Statistical Analysis using Excel during Summer School on "Analytical Techniques for Decision Making in Agriculture" held at ICAR-National Institute of Agricultural Economics and Policy Research (NIAP) during 16 July - 05 August 2015.

Dr. MA Iquebal

- A lecture and hands-on on Data cleaning and pre-processing, genome assembly and metagenome analysis in the Workshop on Accelerating Data-intensive Genome Analysis in Wheat jointly organized by ICAR-IIWBR, Karnal and ICAR-IASRI, New Delhi at ICAR-IIWBR, Karnal during 12-14 May 2015.
- A lecture and Hands on sessions on NGS data analysis: Transcriptome analysis in chickpea and its applications during Summer School on "Novel genomic tools and modern breeding approaches for enhancing productivity and nutritional quality of pulse crops" at ICAR-IIPR, Kanpur from 05-25 September 2015.
- Five lectures and Hands on sessions on i) Data Cleaning and Pre-Processing, ii) Genome Assembly, iii) Genome Annotation (Structural and functional), iv) Transcriptome Analysis (Reference and denovo) and v) Metagenome Analysis during National Workshop on Current Advances on Agricultural Bioinformatics held at ICAR-National Academy of Agricultural Research Management, Hyderabad during 22-24 September 2015.
- Four lectures on i) Data cleaning and pre-processing, ii) Genome assembly, iii) Transcriptome sequence analysis and iv)

miRNA prediction and its target identification during Training-cum-Workshop on Biological Data Analysis through Computational Approach organized at CSIR-North East Institute of Science and Technology, Jorhat, Assam during 08-10 December 2015. (lecture and hands-on training)

- A lecture and hands-on session on Genome Assembly, Transcriptome Analysis and Metagenomic analysis during National Workshop on "Bioinormatics-based Genomic and Proteomic Data Analysis in Microbial Domain" during 04-09 March 2016.

Dr. AR Rao

- Three lectures on i) Use of R for multivariate data analysis (ii) Use of R in genetics and plant breeding and (iii) Use of R in genomics and bioinformatics in training programme on "R-software" at Chaudhary Charan Singh University, Meerut during 09-10 January 2016.

Dr. UB Angadi

- Two lectures on i) Case study: Database and expert system in Animal feed resources and ii) ICT in Agriculture during Summer School on "Analytical Techniques for Decision Making in Agriculture" held at ICAR-National Institute of Agricultural Economics and Policy Research (NIAP) during 16 July - 05 August 2015.

Dr. N. Srinivasa Rao

- A lecture on Data center and its services in ICAR during Summer School on "Analytical Techniques for Decision Making in Agriculture" held at ICAR-National Institute of Agricultural Economics and Policy Research (NIAP) during 16 July - 05 August 2015.
- Dr. N. Srinivasa Rao : A lecture on "Creating own webpages: Google Sites" during 21days CAFT training programme on "Communication and management tools and approaches for agricultural extension" during 02-22 September, 2015 at IARI, New Delhi.

Dr. Sarika

- A lecture on Genome annotation during DBT sponsored Workshop-cum-Training programme on "Bioinformatics Techniques for Agricultural Data Analysis" at Agricultural Knowledge Management Unit, IARI, PUSA, New Delhi on 12 January 2016.
- Lecture and Hands on Molecular Marker Discovery, Transcriptome Sequence Analysis, Genome Annotation. in the Workshop on Accelerating Data-intensive Genome Analysis in Wheat jointly organized by ICAR-IIWBR, Karnal and ICAR-IASRI, New Delhi at ICAR-IIWBR, Karnal during 12-14 May 2015.

Dr. KK Chaturvedi

- A lecture on Mining Software Engineering Repositories: Issues and Challenges during UGC Sponsored National Seminar on "A Step Towards Soft Computing: Techniques and Applications" at Department of Computer Science, Deen Dayal Upadhyay College (University of Delhi) during 18-19 March 2016.

Dr. SK Sarkar

- A lecture on Testing of hypothesis in Refresher course in Basic Sciences organised during 05-25 May 2015 in the UGC-Academic Staff College of Jamia Millia Islamia. (Central University)

Dr. PK Mehar

- A lecture on Biological sequence analysis and secondary structure prediction using R-software in Workshop on Computational Identification of MicroRNA (miRNA) for Biotic & Abiotic Stress Tolerance in Plants organized by Uttarakhand Council of Biotechnology during 09-11 June 2015 at Dehradun.
- A lecture on R-software during Workshop on "Genetical Data Analysis Using R-software" in the Division of plant Breeding and Genetics of CCS University, Meerut, during 09-10 January 2016.

Dr. Eldho Varghese

- Two lectures on Overview of SPSS during Summer School on "Analytical Techniques for Decision Making in Agriculture" held at ICAR-National Institute of Agricultural Economics and Policy Research (NIAP) during 16 July - 05 August 2015.
- Two lectures i) SPSS: An overview and ii) Descriptive statistics and exploratory data analysis using SPSS during Training Programme on Research and Technology, Statistical Analysis and Use of SPSS for Analyzing Statistical Data at Jagannath International Management School (JIMS), Vasant Kunj, New Delhi on 18 December 2015.

Dr. RK Paul

- A lecture on Statistical models for forecasting volatile crop yield at Department of Agriculture

and Food Engineering, IIT-Kharagpur on 13 October 2015.

Dr. Sukanta Dash

- A lecture on JMP Genomics an overview during Training Programme on Genomics and Proteomics Analysis using High Throughput Computing Software organized at NBFGR, Lucknow on 24 November 2015.

Sh. Kanchan Sinha

- A lecture on Time series analysis using SAS during Training Programme held at Division of Agricultural Economics, ICAR-IARI, New Delhi on 19 December 2015.

Dr. Arpan Bhowmik

- Seven lecture (a.) Basic concept and some important terminology, b.) Basic design of experiments including designs for field experiment, c.) Analysis of variance, d.) Comparison of means through DMRT, Tukey's test, e.) Principle component analysis, f.) Cluster analysis and g.) Data diagnostics) during Training programme on Advances in Plant Growth Promoting Rhizobacteria: Diversity to Utility at ICAR-NBAIM during 11-20 January 2016.

Participation

Conferences/Workshops/Trainings/Seminars/ Symposia etc.

- Workshop on Impact Assessment of Agricultural Research and Development on 17 March 2015 at National Institute of Agricultural Economics and Policy Research (NIAP), New Delhi. (Dr. RK Paul)
- Workshop on Making Engineering Scientists Contribution More Meaningful to Stake Holders and the Nation at New Delhi on 13 April 2015. (Dr. Hukum Chandra)
- Engineer's Meet organized by the Agricultural Division of ICAR on 13 April 2015 at NASC Complex, New Delhi. (Dr. Seema Jaggi)
- Workshop on "Advanced Persistent Threats" at Electronic Niketan, CGO Complex organized by CERT.IN. (Dr. Mukesh Kumar)
- International conference on Low Temperature Science and Biotechnological Advances on 27 April 2015 at NASC Complex (Dr. UC Sud)
- Annual Day of National Institute of Agricultural Economics and Policy Research (NIAP) followed by 8th Professor Dayanatha Jha Memorial Lecture by Dr. Kirit S. Parikh on 02 May 2015at NIAP, IASRI campus, New Delhi. (Dr. UC Sud)
- Methodology Workshop of APEDA funded project entitled "Effect of Buffaloes Slaughter and Meat Export Policy on Livestock, Meat, Milk, Draught Power And Eco-Balance" held on 08 May 2015 at NRC Meat Hyderabad to finalize the sampling methodology. (Dr. AK Choubey)
- Workshop on "Accelerating Data-intensive Genome Analysis in Wheat" jointly organized by ICAR-IIWBR, Karnal and ICAR-IASRI, New Delhi at ICAR-IIWBR, Karnal during 12-14 May 2015. (Dr. Dinesh Kumar as Resource Person)
- Annual Vice-Chancellors' (VC) conference of the State Agricultural Universities (SAUs) and Interface meeting with ICAR Directors held from 14-16 May 2015 at NASC Complex, New Delhi (Dr. UC Sud)
- ICAR Directors' Conference held at NASC Complex, New Delhi during 14-16 May 2015. (Dr. UC Sud, Dr. AK Choubey and Dr. Mukesh Kumar)
- ICAR-AGRI SEARCH 2050 on 18 May 2015 at NASC Complex, New Delhi. (Dr. UC Sud)
- Workshop on Advanced Web Application Security on 22 May 2015 at Electronic Niketan, CGO Complex organized by CERT.IN. (Sh Rakesh Kr Saini)
- Workshop on Impact Assessment of Agricultural Research in India at ICAR-NCAP, New Delhi during 25-29 May 2015. (Dr. RK Paul)
- Fourth Annual Review Workshop of National Agricultural Science Fund during 28-29 May 2015 at A.P. Shinde Symposium Hall, NASC Complex, New Delhi. (Dr. AR Rao and Sh. Sanjeev Kumar)
- International Conference on Recent Advances in Mathematics, Statistics and Computer Science (ICARMSCS-2015) during 29-31 May 2015 at the School of Mathematics. Statistics and Computer Science, Central University of South Bihar, Patna, India. (Prakash Kumar)
- National Academy of Agricultural Sciences Silver Jubilee followed by lectures of Prof. MS Swaminathan, Former Member of Rajya Sabha, Govt, of India:UNESCO Cousteau Chair in Ecotechnology and Chairman, MSSRF, Chennai, Dr. David Begvinson, Director General, ICRISAT, Hyderabad & Dr. K.H.M. Siddique, Hackett Professor & Director. UWA Institute of

Agriculture, Australia on 03 June 2015. (Dr. UC Sud)

- One day Conference on Museum Maintenance at India International Centre , Max Muller Marg, New Delhi on 06 June 2015. (Sh. Pal Singh)
- Launch of CRP-Genomics by DG, ICAR, New Delhi at ICAR-NBFGR, Lucknow on 12 July 2015 at Lucknow. (Dr. UC Dud and Dr. Anil Rai)
- Altair Technology Conference ATCx 2015 held at Le Meridien, New Delhi on July 17, 2015. (Dr. UB Angadi, Dr. SB Lal, Mr. Jai Bhagwan)
- Popular talk on Monitoring Agricultural ResourceS (MARS): Experience of European Union by Dr. Jacques Delincé, Senior Statistician, FAO, Rome organized by Indian Society of Remote Sensing (Delhi Chapter) & Indian Society of Agrophysics on 24 July 2015 at IARI, New Delhi. (Dr. Ankur Biswas and Mr. Kanchan Sinha)
- First workshop of Nodal Officers of KRISHI: Knowledge based Resources Information Systems Hub for Innovations in Agriculture (ICAR Research Data Repository for Knowledge Management) held at NASC Complex, New Delhi during 04-05 August 2015 . (Dr. UC Sud, Dr. Seema Jaggi, Dr. Rajender Parsad, Dr. AK Choubey Dr. Mukesh, Kumar, Dr. Anshu Bhardwaj, Dr. Alka Arora Dr. Ajit, Dr. Anil Kumar, Dr. Susheel Kumar Sarkar, Dr. Arpan Bhowmik, Ms. Vandita Kumari Choudhary and Sh. Raju Kumar)
- 54th All India Wheat & Barley Research Workers' Meet held at SD Agricultural University, Sardarkrushinagar, Dantiwada, Gujrat during 21-24 August 2015. Actively participated in the session on Crop Improvement and discussed the issues relating to designing and analysis of varietal trials and criterion of promotion of entries. (Dr. Rajender Parsad)
- National Conference on Bioinformatics Panorama in Agriculture and Health (NCBPAH 2015) at SHIATS, Allahabad during 05-06 October 2015. (Dr. MA Iquebal)
- 15th National IT Seminar on Cyber Security: Issues and Challenges organized by Management Education and Research Institute (MERI) and Computer Society of India(CSI), Delhi Chapter on 10 October 2015. (Dr. Alka Arora and Dr. Sudeep)
- International Conference on Extension Research Interface - Promoting Exportable Rice Varieties and Evolving a Sustainable Development Model held at New Delhi during 16-18 October 2015. (Dr. KN Singh)
- Workshop on Vigilance Awareness week on the theme of Preventive Vigilance as a tool of Good Governance on 28 October 2015 at NASC Complex, New Delhi. (Dr. UC Sud)
- Review workshop of Network project on Market Intelligence at ICAR-NIAP, New Delhi during 30-31 October 2015. ((Dr. RK Paul)
- 42nd Foundation Day Function of ASRB on 03 November, 2015 at Dr BP Pal Auditorium, ICAR-IARI, New Delhi. (Dr. UC Sud, Dr. AK Gupta and Dr. Mukesh Kumar)
- Workshop on Foresight Mehodologies - Theory and Practices organized by TIFAC at Vigyan Bhavan Annex, New Delhi on 27 November 2015. (Mr. Mrinmoy Ray and Mr. Santosha Rathod)
- International Conference on Statistics and Related Areas for Equity, Sustainability and Development (SRAESD-2015) and delivered PV Sukhatme lecture during 28-30 November 2015 at Department of Statistics, University of Lucknow, Lucknow (Dr. UC Sud)
- ESRI Users conference from 02-04 December 2015 held at New Delhi. (Dr. Prachi Misra Sahoo)
- Seven International workshop on Big Data nahchmarking held at India habitat Centre, New Delhi during 14-15 december 2015. (Dr. K K Chaturvedi and Sh. Soumen pal)
- 103rd Indian Science Congress held in Mysuru from 03-07 January 2016 (Dr. Anil Rai)
- 31st Annual Conference of the AICRP on PHT at TNAU, Coimbatore on 06 January 2016. (Dr. AK Choubey)
- ICAR Director's Conference held at NASC Complex, New Delhi on 23-24 January 2016. (Dr. UC Sud, Dr. AK Choubey, Dr. Rajender Parsad and Dr. Mukesh Kumar).
- 54th Convocation programme of PG School, IARI, New Delhi held on 05 February 2016 (All Faculty Members)
- National Workshop on Appraisal cum Data Validation of NISAGENET at Indira Gandhi Krishi Vishwavidyalaya, Raipur during 18-19 February 2016. (Dr. Sudeep and Sh Pal Singh)
- 18th Annual Conference of Society of Statistics Computer and Applications (SSCA) organized

at Department of Statistics, University of Jammu, Jammu during 18-20 February 2016. (Dr. Rajender Parsad, Dr. LM Bhar, Dr. Hukum Chandra, Dr. RK Paul, Dr. Mukesh Kumar, Dr. Alka Arora and Dr. Sangeeta Ahuja and Dr. Raju Kumar)

- National Workshop on Strengthening and Sustainability of E-Granth during 26-27 February 2016 at NASC, New Delhi. (Dr. Rajender Parsad, Dr. Susheel Kumar Sarkar and Dr. Mukesh Kumar)
- National Science Day Celebration at the Institute on 27 February 2016. (Director, All Scientists and Technical Officers)
- International Conference on Informatics, Management and Technology of Solar Energy-Issues and Opportunities (ICIMTSE-2016), organized by MERI College of Engineering and Technology Management Education And Research Institute at IIC, Lodhi Estate, New Delhi during 01-02 March 2016. (Dr. Anshu Bharadwaj, Dr. Alka Arora and Dr. N Srinivasa Rao)
- Leadership Workshop on Enhancing Organizational Productivity through Management of People at Work organized by NAARM at NASC Complex, New Delhi on 02 March 2016. (Dr. Seema Jaggi and Dr. AK Gupta)
- National Seminar on Recent Advances in Statistical Tools for Agriculture and Allied Sciences organized by Society for Application of Statistics in Agricultural and Allied Sciences (SASAA) in collaboration with Department of Agricultural Statistics, Bidhan Chadra Krishi Viswavidyalaya, Mohanpur and Indian Institute of Science Education and Research, Kolkata (http://www.iiserkol.ac.in/) during 03-05 March 2016. (Dr. RK Paul and Dr. MA Iquebal).
- Review workshop of the Network Project on Impact Assessment of Agricultural Research and Development held during 07-09 March, 2016 at NIAP, New Delhi.(Dr. RK Paul)
- Workshop on ICAR-KRISHI Geoportal–Experts organized at NBSS&LUP, Nagpur during 11-12 March 2016 under KRISHI Project. (Dr. Anshu Bharadwaj)
- 10th INDIACom-2016; IEEE International Conference on Computing for Sustainable Global Development, 16–18 March 2016 Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi. (Dr. Anshu Bharadwaj, Dr. Mukesh Kumar and Dr. Alka Arora)
- Brainstorming Session on Spreading Quality Teaching organized by INSA, New Delhi on 29 March 2016. (Dr. Seema Jaggi)
- National Workshop on Geospatial Analysis in Agriculture under ICAR-KRISHI, NAARM, Hyderabad during 29-30 March, 2016 under KRISHI Project. (Dr. Anshu Bharadwaj)

Krishi Unnati Mela

- The Institute participated in the Krishi Unnati Mela 2016 organised by IARI, New Delhi during 19-21 March 2016 and elevated a stall to exhibit its significant research findings and software. The stall attracted a huge number of visitors including farmers, students and entrepreneurs. Through live demonstrations and posters, the developed technologies were explained to the visitors.
- The institute participated in the celebration of Jai Vigyan Jai Kisan Program jointly organized by Delhi based ICAR institutes on December 25, 2015 as a part of Kisan week celebration during 23-29 December 2015 at ICAR-IARI, New Delhi. A stall was elevated to demonstrate the farmer oriented technologies.

Trainings Attended

- One month Orientation Training at IASRI from 17 April to 16 May 2015. Familiarized with the organizational structure of IASRI. Interacted with scientists from all the divisions and gathered valuable information related to their various activities - research, training and teaching. Visited IARI, NIAP, NCIPM and NBPGR under this training. Got familiarized with their research activities. Also visited NASM and gathered a brief idea about the museum and various agricultural practices of ancient civilizations. (Sh. Sunil Kumar)
- Three months Professional Attachment Training at Department of Statistics, Calcutta University, Kolkata from 03 August to 02 November 2015. (Sh. Sunil Kumar Yadav)
- Training programme on Geospatial analysis for natural resources management using statistical tools at NAARM, during 02-11 September 2015. (Dr. Prawin Arya)

VISIT ABROAD

Dr. UC Sud

- Visited FAO, Rome during 15-18 April and 23 June to 01 July, 2015 to attend Expert meeting on Improving methods for estimating area, yield and production under mixed and continuous cropping and Improving methods on estimating post harvest losses held at Food and Agriculture Organization (FAO) Headquarter, Rome, Italy.
- Visited Jakarta, Indonesia as Resource Person for imparting training to Enumerators and Supervisors for primary data collection and to supervise live data collection under the project "Research on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" during 18-23 December, 2015.
- Visited the Rwanda as Resource Person for imparting training to Enumerators and Supervisors for primary data collection and supervise live data collection under the project "Research on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" in Kigali, Rwanda during 03-09 January, 2016.
- Visited Jamaica as Resource Person for imparting training to Enumerators and Supervisors for primary data collection and supervise live data collection under the project "Research on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" in Kingston, Jamaica during 27 January to 04 February 2016.

Dr. Tauqueer Ahmad

- Visited FAO, Rome during 15-18 April 2015 to attend Expert meeting on Improving methods for estimating area, yield and production under mixed and continuous cropping and Improving methods on estimating post harvest losses held at Food and Agriculture Organization (FAO) Headquarter, Rome, Italy.
- Visited Jakarta, Indonesia as Resource Person for imparting training to Enumerators and Supervisors for primary data collection and to supervise live data collection under the project "Research on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" during 18-23 December 2015.
- Visited Rwanda as Resource Person for imparting training to Enumerators and Supervisors for primary data collection and supervise live data collection under the project "Research on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" in Kigali, Rwanda during 03-09 January 2016.
- Visited Jamaica as Resource Person for imparting training to Enumerators and Supervisors for primary data collection and supervise live data collection under the project "Research on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" in Kingston, Jamaica during 27 January to 04 February 2016.

Dr. Hukum Chandra

- Visited Sri Lanka as International Consultant, for short term FAO consultancy under Global Strategy to Improve Agricultural and Rural Statistics in Sri Lanka during 16-26 June 2015.
- Visited Daejeon, Republic of Korea during 13-17 July 2015 for attending the Regional Workshop on "Statistical Literacy".
- Visited Rio De Janeiro, Brazil during 26-31 July 2015 to attend the 60th International Statistics Institute World Statistics Congress 2015 as Invited speaker. Dr Hukum Chandra acted as Chairman of Technical Session on Survey Statistics at the Congress.
- Visited Japan to attend Regional Workshop on Training of Trainers for Official Statistics and Second Expert Group Meeting of the Network for the Coordination of Statistical Training in Asia and the Pacific during 29 February - 04 March 2016.
- Visited Jakarta, Indonesia for supervision of data collection work under the Food and Agriculture Organization of United Nations funded project entitled "Research on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" during 13-19 March 2016.

Dr. Man Singh

- Visited Jakarta, Indonesia for supervision of data collection work under the Food and Agriculture Organization of United Nations funded project entitled "Research on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" during 13-19 March 2016.

12

Conference,Workshops, Meetings, Seminars and Annual Day Organized

Conference Sessions

Dr. Anil Rai

- Co-chaired a session in National Workshop on Current Trends in Agricultural Bioinformatics jointly organized by ICAR-NAARM & ICAR-IASRI during 22-24 September 2015.

Dr. Hukum Chandra

- Convened the Technical Session entitled Recent Advances in Small Area Estimation in the International Indian Statistical Association Conference 2015 (IISA 2015) at Pune during December 20-22, 2015.
- Convener, invited technical session on Advances in Sample Surveys in the 18th Annual Conference of Society of Statistics, Computer and Applications, Jammu, India, 18-20 February 2016.
- Chaired technical session on Agricultural Statistics, Agricultural Economics, Extension, Education & Home Science in 2050 in Agri Search 2050, New Delhi, May 18, 2015.
- Chaired technical session in the 18th Annual Conference of Society of Statistics, Computer and Applications, Jammu, India during 18-20 February 2016.
- Chaired technical session on Recent Advances in Sample Surveys, International Conference on Statistics, Science, and Society: New Challenges and Opportunities (IISA 2013), organized by International Indian Statistical Association, Chennai, India, 02-05 January 2013.
- As Convenor, organised an invited technical session entitled “Recent Advances in Small Area Estimation” in the International Indian Statistical Association Conference 2015 (IISA 2015), Pune, India, 20-24 December 2015.
- As Convener, organised an invited technical session on Advances in Sample Surveys in the 18th Annual Conference of Society of Statistics, Computer and Applications, Jammu, India, 18-20 February 2016.

Dr. Rajender Parsad

- Chaired a Workshop Session on Big Data Analytics in Agriculture during Seventh Workshop on BIG DATA BENCHMARKING held at India Habitat Centre, New Delhi during 14-15 December 2015
- Chaired a Technical Session on Statistical Computing and Big Data Analytics during 18th Annual Conference of Society of Statistics, Computer and Application organized at University of Jammu, Jammu during 18-20 February 2016.

Dr. AR Rao

- Chaired a session track – I on Genomics at the International Conference on Bioinformatics and Systems Biology organized at Indian Institute of Information Technology, Allahabad, India during 04-06 March 2016.

Dr. Dinesh Kumar

- Co-Chaired one session in National Conference on Bioinformatics Panorama in Agriculture and Health (NCBPAH 2015) at SHIATS, Allahabad during October 05-06, 2015 organized by Department of Computational Biology and Bioinformatics, JSBB, SHIATS, Allahabad in collaboration with Society for Bioinformatics

and Biological Sciences and Indian Institute of Information Technology, Allahabad.

Dr. Alka Arora

- Co-convener for the session Informatics-Advances and Issues organized in the 18th Annual Conference of Society of Statistics, Computer and Applications held at Jammu University.

Dr. KK Chaturvedi

- Chaired the session IT Applications in the 4th International Conference on Reliability, Infocomm Technologies and Optimization (ICRITO' 2015) at Amity University, Noida during 02-04 September 2015.

69th Annual Conference of the Indian Society of Agricultural Statistics

The Conference was organized at University of Kota, Kota, Rajasthan during 14-16 December 2015. Scientists of the Institute were involved in various capacities as mentioned below:

- Session on "Emerging Issues in Basic Research in Statistics"
  Convener: Dr. Rajender Parsad
- Session on "Issues in Collection and Analysis of Large Scale Agricultural Data"
  Rapporteur: Dr Kaustav Aditya
- Session on "Statistical Issues in Technology Foresight"
  Convener: Dr. KN Singh
  Rapporteur: Dr. RK Paul
- Session on "New Challenges in Teaching and Training in Agricultural Statistics and Informatics"
  Convener: Dr. Seema Jaggi
  Rapporteur: Dr. Arpan Bhowmik
- Session on "Advances in Agricultural Informatics"
  Chairman: Dr. AK Choubey
  Convener: Dr. Anil Rai
  Rapporteur: Sh. Prakash Kumar
- Session on "Statistical Modelling"
  Rapporteur: Sh. Samrender Das
- Session on "Sampling Surveys and Applications"
  Rapporteur: Dr. AK Gupta
- Session on "Design of Experiments"
  Chairman: Dr. Amrit Kumar Paul
  Rapporteur: Dr. BN Mandal
- Session on "Statistical Genetics/ Informatics/ Bioinformatics"
  Chairman: Dr. Anil Rai
  Convener: Dr. AK Paul
  Rapporteur: Dr. Susheel Kumar Sarkar

Teacher's Day

The Teacher's Day was celebrated on 04 September 2015 in which Dr. SK Raheja was Chief Guest and Dr. Randhir Singh was the Honoured Teacher.

Annual Day Celebrations

The Annual Day of the Institute was celebrated on July 2, 2015. Dr. Alok Kumar Sikka, DDG (NRM) ICAR, New Delhi presided over the function and Dr. Ashok Kumar Singh, Deputy Director General, Agricultural Extension, delivered the Nehru Memorial Lecture.

Annual Day

Nehru Memorial Gold Medal for the year 2012-14 was awarded to Md. Harun, M.Sc. (Agricultural Statistics) student, Ms. Sanchita Naha, M.Sc. (Computer Application) student and Ms. Puru Supriya, M.Sc. (Bioinformatics).

हिन्दी सप्ताह का आयोजन

संस्थान में 07 से 14 सितम्बर 2015 के दौरान हिन्दी सप्ताह का आयोजन किया गया। दिनांक 07 सितम्बर, 2015 को हिन्दी सप्ताह का उद्घाटन संस्थान के निदेशक, डॉ. उमेश चन्दर सूद द्वारा किया गया। हिन्दी उद्घाटन के तत्पश्चात काव्य-पाठ का आयोजन किया गया। हिन्दी सप्ताह के दौरान "डॉ. दरोगा सिंह स्मृति व्याख्यान" के साथ-साथ वैज्ञानिक प्रभागों में हिन्दी में सर्वाधिक वैज्ञानिक कार्य करने के लिए प्रभागीय चल-शील्ड के साथ-साथ काव्य-पाठ, वाद-विवाद, प्रश्न-मंच, अन्ताक्षरी, हिन्दीतर कर्मियों के लिए हिन्दी श्रुतलेख एवं शब्दार्थ लेखन प्रतियोगिता आयोजित की गयी । प्रश्न-मंच एवं अन्ताक्षरी प्रतियोगिता के संचालकों द्वारा इन प्रतियोगिताओं को ऑडियो विजुअल रूप में प्रस्तुत किया गया जिससे ये प्रतियोगिताएँ अत्यन्त ही रोचक रहीं। सभी प्रतियोगिताओं में छात्रों सहित संस्थान के विभिन्न वर्गों के कर्मियों ने बढ़-चढ़कर हिस्सा लिया । संस्थान में प्रत्येक वर्ष हिन्दी दिवस के अवसर पर डॉ. दरोगा सिंह स्मृति व्याख्यान का आयोजन किया जाता है जिसमें किसी सुप्रसिद्ध वैज्ञानिक द्वारा किसी भी वैज्ञानिक विषय पर हिन्दी में व्याख्यान दिया जाता है । इस वर्ष इस कड़ी का चौबीसवाँ व्याख्यान भारतीय कृषि सांख्यिकी अनुसंधान संस्थान के पूर्व निदेशक, डॉ. विजय कुमार भाटिया जी द्वारा "कृषि सांख्यिकीय में मेरा अनुभव" विषय पर दिया गया और इस कार्यक्रम की अध्यक्षता आई. सी.एम.आर. के पूर्व अपर महानिदेषक एवं राष्ट्रीय सांख्यिकीय आयोग के सदस्य, डॉ. पदम सिंह जी द्वारा की गयी । दिनांक 14 सितम्बर, 2015 को हिन्दी सप्ताह के समापन समारोह के अवसर पर इस दौरान आयोजित प्रतियोगिताओं के सफल प्रतियोगियों को पुरस्कृत करने के साथ-साथ वर्ष 2014-15 के दौरान "सरकारी कामकाज मूल रूप से हिन्दी में करने

हिन्दी सप्ताह

के लिए प्रोत्साहन योजना" के अन्तर्गत भी नकद पुरस्कार प्रदान किये गये । इसके अतिरिक्त, जुलाई 2014 से सितम्बर, 2015 तक की अवधि के दौरान संस्थान में आयोजित हिन्दी कार्यशालाओं के वक्ताओं को भी सम्मानित किया गया।

Seminars

Salient outcomes from the completed research projects undertaken on different aspects of Agricultural Statistics, Computer Application and Bioinformatics were presented in the seminars organized regularly at the Institute. Open seminars were also organized for new research project proposals. Outline of Research Work (ORW) seminars, Course seminars and Thesis seminars were delivered by the students of M.Sc. and Ph.D. (Agricultural Statistics), M.Sc. and Ph.D. (Computer Application) and M.Sc. (Bioinformatics). During the period under report, a total of 115 seminar talks were delivered. Out of these, 99 were student seminars, 11 by scientists of the Institute and 04 by Guest Speakers i) Prof. Bikash Sinha, Former Member National Statistics Commission and Professor, Indian Statistical Institute, Kolkata, on Into the mysterious world of *p* the Bernoulli parameter delivered on 08 June 2015; ii) Dr. Dulal K. Bhowmick, Director, BRC, University of Illinois on Statistical methodologies in neuro-connectivity analysis using fMRI data in autism delivered on 21 December 2015; iii) Dr. Balgobin Nandram, Professor of Statistics, Worcester Polytechnic Institute, USA on My association with USDA's NASS delivered on 26 December 2015 and iv) SPSS Team on Demonstration on SPSS Software along with SPSS Online Training for Govt. Officials delivered on 21 January 2016.

One seminar was delivered by Vigilance Officer of the Institute.

Details of Seminars Delivered

Category	Type	Number
Scientists	Project Completion	3
Scientists	New Project Proposals	8
Students, Ph. D. (Ag. Statistics)		15
Students, M. Sc. (Ag. Statistics)		29
Students, M. Sc. (Bioinformatics)		17
Student, M.Sc. (CA)		17
Student, Ph. D. (CA)		2
Student, Ph.D. (Bioinformatics)		16
Student, Ph.D., Agril. Engg.		3
Guest Speaker		4
Speaker Vigilance Officer		1
		115

Workshops under various Projects

S. No.	Title	Venue	Date	Sponsored by	Participants
	Workshops under MIS/FMS				
1.	Four days' Workshop on "Payroll and HR module" specially conducted for IARI personnel Cordinator : Dr. Mukesh Kumar	ICAR-IASRI, New Delhi	05- 08 May 2015	ICAR-IASRI New Delhi	41
2.	Workshop on "Unified Communications" for the personnel of various SMD's of ICAR Cordinators : Dr. Alka Arora : Dr. N Srinivasa Rao	ICAR-IASRI, New Delhi	06 November 2015	ICAR-IASRI, New Delhi	26
3.	Zonal training workshops on "Unified Communication Solution" Cordinators:				
	Dr. Mukesh Kumar Sh. Subhash Chand	ICAR-NAARM Hyderabad	05 December 2015	ICAR-IASRI, New Delhi	30
	Dr. Sudeep| Sh. Rakesh Saini	ICAR-CIFE, Mumbai	16 December 2015	ICAR-IASRI, New Delhi	86
	Dr. Alka Arora Sh. Subhash Chand	ICAR-CIFRI, Kolkata	18 December 2015	ICAR-IASRI, New Delhi	35
	Sh. Rakesh Saini Sh. Subhash Chand	ICAR-IVRI, Bareilly	22 December 2015	ICAR-IASRI, New Delhi	102

S. No.	Title	Venue	Date	Sponsored by	Participants
	Workshops under CABin				
4.	Workshop on "Bioinformatics Tools" for Fish Genomics jointly organized with ICAR-CIFA, Bhubaneswar Cordinator : Dr. MA Iquebal	ICAR-CIFA, Bhubaneswar	21-22 April 2015	CABin Scheme	18
5.	Workshop on "Accelerating data-intensive genome analysis" in wheat Cordinator : Dr. Sarika	ICAR-IIWBR, Karnal	12-14 May 2015	CABin Scheme	12
	Workshops under DBT Fish Genome				
6.	DBT Fish genome project Second Partner's Meet Cordinator : Dr. Dinesh Kumar	ICAR-IASRI, New Delhi	07 May 2015	DBT, New Delhi	9
	Workshops under under ICAR Research Data Repository for Knowledge Management Initiative				
7.	First Workshop of "Nodal Officers of ICAR research data repository" for knowledge management initiative Cordinator : Dr. Rajender Parsad	NASC Complex New Delhi	04-05 August 2015	ICAR-IASRI	96 Institutes (Nodal officers & other delegates)
	Workshops under AICRP-IFS				
8.	Joint Workshop of "ICAR-IASRI and ICAR- IIFSR" under AICRP-IFS on Statistical Issues in Farming Systems Research for finalizing the On-Station and ON-FARM data analysis methodology Cordinator : Dr. Anil Kumar	ICAR-IASRI New Delhi	24 November 2015	AICRP-IFS	31
	Workshops under AFEIS				
9.	"Agricultural Field Experiments Information System (AFEIS) project" Cordinator : Dr. Susheel Kumar Sarkar	ICAR-IASRI New Delhi	05-06 November 2015	ICAR-IASRI New Delhi	26
	Hindi Workshops				
10.	एस.पी.एस.एस. द्वारा आंकड़ों का विश्लेषण एवं रिपोर्ट सृजन (Data analysis and report generation using SPSS) for the "Technical Personnel" of ICAR-IASRI Cordinators : Dr. Arpan Bhowmik : Dr. Eldho Varghese	ICAR-IASRI New Delhi	02 September 2015	ICAR-IASRI New Delhi	23
11.	Workshop in Hindi on "Testing of Hypothesis" for the technical staff of ICAR-IASRI Cordinators : Dr. Eldo Varghese Dr. Sunil Yadav	ICAR-IASRI New Delhi	14 December 2015	ICAR-IASRI New Delhi	16
12.	उन्नत सॉफ्टवेयर पैकेजों का प्रयोग करते हुए कृषि में पूर्वानुमान तकनीकों का प्रयोग Cordinators : Dr. Wasi Alam Sh. Kanchan Sinha	ICAR-IASRI New Delhi	26-31 March 2016	ICAR-IASRI New Delhi	12

S. No.	Title	Venue	Date	Sponsored by	Participants
	Other Workshops				
13.	National Workshop on "Current Trends in Agricultural Bioinformatics" jointly organized by ICAR-NAARM & ICAR-IASRI Cordinator : Dr. Dinesh Kumar	ICAR-NAARM Hyderabad	22-24 September 2015	ICAR-NAARM Hyderabad	44
14.	A Workshop on "Overview of Research in Statistics and Informatics" in Last 40 years to felicitate Professor VK Gupta on his superannuation. Cordinators : Dr. Rajender Parsad Dr. Seema Jaggi	ICAR-IASRI New Delhi	17 March 2016	Students of Dr. VK Gupta	

13

Distinguished Visitors

Dr. S Ayyappan
Former Secretary (DARE) & DG (ICAR)
Indian Council of Agricultural Research (ICAR),
New Delhi

Dr. K Algusundaram,
Deputy Director General (Engineering)
Indian Council of Agricultural Research (ICAR),
New Delhi

Dr. AK Singh
Deputy Director General (Ag. Ext.)
Indian Council of Agricultural Research (ICAR),
New Delhi

Dr. NS Rathore
Deputy Director General (Education),
Indian Council of Agricultural Research (ICAR),
New Delhi

Dr. Jeet Singh Sandhu
Deputy Director General (Crop Sciences)
Indian Council of Agricultural Research (ICAR),
New Delhi

Dr. AK Sikka
Former DDG(NRM)
Indian Council of Agricultural Research (ICAR),
New Delhi

Professor Bimal K. Roy
Indian Statistical Institute, Kolkata.

Sh. TV Raman
Additiona Director General (Training)
Ministry of Statistics and Programme
Implementation, Government of India

Prof. Saumyadipta Pyne
Professor, Public Health Foundation of India,
Indian Institute of Public Health (IIPH), Hyderabad

Shri GC Manna
DDG (NAD),
Central Statistics Office, MOS& PI, New Delhi

Dr. Kanchan K Singh
ADG (FE), ICAR, New Delhi

Dr. Suresh K Chaudhari
ADG (SW&M), ICAR, New Delhi

Dr. AK Vashishtha
ADG (PIM/ESM), ICAR, New Delhi

Dr. SN Jha
ADG (PE), ICAR, New Delhi

Dr. BS Prakash
ADG (ANP), ICAR, New Delhi

Dr. SD Singh
ADG (Inland Fisheries), ICAR, New Delhi

Dr. MB Chetti
ADG (HRD), ICAR, New Delhi

Dr. Venkateshwarlu
ADG (EQA&R), ICAR, New Delhi

Dr. PK Agarwal
ADG (NASF), ICAR, New Delhi

Dr. Rameshwar Singh
Project Director, DKMA, ICAR, New Delhi

Dr. Kalpana Shashtri
Joint Director, ICAR-NAARM, Hyderabad

Sh. AK Srivastava
Former DDG (FOD), NSSO, MNCFC

Dr. Bal BPS Goel
Former Director,
ICAR-IASRI, New Delhi

Dr. SK Raheja
Former Director, ICAR-IASRI, New Delhi

Dr. SD Sharma
Former Director,
ICAR-IASRI, New Delhi & Former Vice-Chancellor,
Dev Sanskriti Vishwavidalaya, Haridwar

Dr. VK Bhatia
Former Director, ICAR-IASRI, New Delhi

Dr. AK Srivastava
Former Joint Director, ICAR-IASRI, New Delhi

Dr. (Smt.) Ravinder Kaur
Director (A), ICAR-IARI, New Delhi

Dr. Suresh Pal
Head, Division of Agricultural Economics,
ICAR-IARI, Pusa, New Delhi -110 012

Dr. Niranjan Prasad
Head, Division of Processing and
Product Development,
ICAR-IINRG, Ranchi

Dr. CR Mehta
Project Coordinator, ICAR-AICRP on FIM,
ICAR-CIAE, Bhopal

Dr. BVS Sisodia
Professor & Head, Deptt. of Statistics,
ADUAT, Kumarganj, Faizabad (UP)

Dr. Randhir Singh
Former Professor, IASRI, New Delhi

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

Dr. SK Das
Advisor(Statistics)
Department of Animal Husbandry, Dairying and
Fisheries
Ministry of Agriculture and Farmers Welfare,
Government of India

Dr. Ajith Kumar
Director
Department of Animal Husbandry, Dairying and
Fisheries
Ministry of Agriculture and Farmers Welfare,
Government of India

Dr. Manoj Kumar Verma
Deputy Director
Department of Animal Husbandry, Dairying and
Fisheries
Ministry of Agriculture and Farmers Welfare,
Government of India

Air Vice Marshall GP Sharma
Head, Mateorology,
Skymet Weather Services, Pvt. Ltd., Noida

Dr. JK Jena, Director
ICAR-NBFGR, Lucknow

Dr. CG Joshi
Head, Animal Biotechnology Division, AAU, Anand

Sh. Anuj Bhargava
Vice President,
Skymet Weather Services, Pvt. Ltd., Noida

Prof. Bikas Sinha
Former Member National Statistics Commission &
Professor, Indian Statistical Institute, Kolkata

International

Dr. Dulal K Bhowmick
Director, BRC, University of Illinois, USA

Dr. Balgobin Nandram
Professor of Statistics
Worcester Polytechnic Institute, USA

Dr. Michael Austin Rahija
Research Officer of the Global Office and
Coordinator, FAO, Rome, Itay

Mr. Sergiy Radyakin
Economist, Development Research Group
World Bank

Annexure-I

LIST OF RESEARCH PROJECTS

DEVELOPMENT AND ANALYSIS OF EXPERIMENTAL DESIGNS FOR AGRICULTURAL SYSTEMS RESEARCH

ICAR National Professor Scheme

Completed

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

On-going

Institute Funded

2. Planning, designing and analysis of data relating to experiments for AICRP on long-term fertilizer experiments. (SIX1206)

   Krishan Lal (till 31.03.2014), BN Mandal (from 01.10.2012 to 21.09.2013 and 22.10.2014 onwards) and LM Bhar (from 01.10.2013 to 30.10.2014): 01.04.2012–31.03.2017

3. Planning, designing and analysis of 'On Farm' research experiments planned for AICRP on IFS. (SIX1207)

   NK Sharma (till 30.09.2014), Cini Varghese (from 01.10.2014), Sukanta Dash (from 01.10.2012) and Arpan Bhowmik (from 01.10.2014): 01.04.2012–31.03.2017

4. Information system for designed experiments. (SIX1208)

   OP Khanduri (till 13.11.2014), DK Sehgal (till 31.08.2012), Soumen Pal (till 30.09.2012 and rejoined w.e.f. 31.10.2015), Susheel Kumar Sarkar (w.e.f. 01.10.2012) and Shashi Dahiya (on study leave from 03.07.2014): 01.04.2012–31.03.2017

5. Planning, designing and analysis of experiments planned 'On Stations' under the AICRP on IFS. (SIX1209)

   Anil Kumar and Eldho Varghese (w.e.f. 01.10.2012): 01.04.2012–31.03.2017

6. Factorial experiments with minimum level changes in run sequences. (AGENIASRISIL201301200013)

   Arpan Bhowmik, Eldho Varghese, Cini Varghese and Seema Jaggi: 16.08.2013-04.04.2016

7. Minimal response surface designs for resource optimization in agricultural experiments. (AGENIASRISIL 201401500034) Eldho Varghese, Arpan Bhowmik, Seema Jaggi and Cini Varghese: 04.09.2014-03.09.2017

8. A optimal block designs for comparing test treatments with control treatment(s)-an algorithmic approach. (AGENIASRISIL201500200039)

   BN Mandal, Rajender Parsad, VK Gupta (till 16.03.2016) and Sukanta Dash: 18.02.2015-17.02.2018

Outside Funded

9. Information system for planning and analysis of experiments on All-India Coordinated Research Project on Vegetable Crops. Funded by AICRP (VC), IIVR, Varanasi. (AGENIASRICOL201400200021)

   ICAR-IASRI: Rajender Parsad and Sukanta Dash, NAARM, Hyderabad: A Dhandapani, IIVR, Varanasi: B Singh, PM Singh (January 2015-10.12.2015), Satyandra Singh (October 2014-May 15, 2015),Major Singh ((since 11.12.2015) and T Choubey: 05.02.2014-31.03.2017

Completed

Outside Funded

10. Experimental designs in the presence of indirect effects of treatments. Funded by DST (SOX1115)

    Seema Jaggi, Cini Varghese, Anu Sharma (till 04.09.2013) and Eldho Varghese: 01.10.2011–30.09.2015

11. Bioacoustics tool: A novel non-invasive approach for different monitoring of health and productivity in dairy animals. Funded by DBT (AGENIASRICOP201300400005)

    NDRI, Karnal: Surender Singh Lathwal, Shiv Prasad, TK Mohanty, Archna Verma, AP Ruhil and SV Singh, ICAR-IASRI: Anil Kumar: 01.02.2013-31.01.2016

New Initiated

Institute Funded

12. Some investigations on trend resistant row-column designs. (AGENIASRISIL201502900066)

    Arpan Bhowmik, Seema Jaggi, Eldho Varghese and Sunil Kumar Yadav: 24.09.2015-31.03.2018

13. On construction of orthogonal and nested orthogonal Latin hypercube designs. (AGENIASRISIL201503200069) Sukanta Dash, Rajender Parsad, B.N.Mandal and Susheel Kumar Sarkar: 16.11.2015-15.11.2018

Outside Funded

14. ICAR Research Data Repository for Knowledge Management as KRISHI: Knowledge based Resources Information System Hub for Innovations in Agriculture. Funded by ICAR Headquarter Plan Scheme under XII Plan period (2012-2017). (AGENIASRICOL201503100068)

    ICAR-IASRI: Rajender Parsad, AK Choubey, Anil Kumar, Mukesh Kumar, Anshu Bharadwaj, Susheel Sarkar, Arpan Bhowmik, Raju Kumar and Vandita Kumari Choudhary

    ICAR-NAARM, Hyderabad: A Dhandapan

    ICAR-NBSS&LUP, Nagpur: GP Obi Reddy, Nirmal Kumar and Sudipto Chattaraj

    ICAR-IARI, New Delhi: Vinay Kumar Seghal and Joydeep Mukerjee

    ICAR-DKMA, New Delhi: Mitali Ghosh Roy

    ICAR-CMFRI, Kochi: J Jayasankar

    ICAR-CRIDA, Hyderabad: NS Raju: 24.07.2015-31.03.2017

FORECASTING, MODELLING AND SIMULATION TECHNIQUES IN BIOLOGICAL AND ECONOMIC PHENOMENA

On-going

Institute Funded

15. Estimation of heritability under correlated errors. (AGENIASRISIL201400100020)

    Amrit Kumar Paul and SD Wahi: 04.01.2014-03.05.2016

16. Study on volatility spillover of agricultural commodity prices. (AGENIASRISIL201401000029)

    Kanchan Sinha, Wasi Alam, Sanjeev Panwar and Bishal Gurung: 12.05.2014-11.05.2016

Outside Funded

17. Network project on market intelligence. Funded by ICAR, DARE, Ministry of Agriculture, New Delhi (AGENIASRICOP201400300022)

    NIAP: Raka Saxena, IASRI: Ranjit Kumar Paul: 13.02.2014-31.03.2017

18. Network project on impact assessment of agricultural research and development. Funded by ICAR. (AGENIASRICOP201500100038)

    NIAP: PS Birthal (till 26.01.2016), Shiv Kumar (since 27.01.2016), Jaya Jumrani, Kingsly IT and SK Srivastava

    IASRI: Ranjit Kumar Paul: 01.01.2015-31.03.2017 (Association of IASRI w.e.f. 12.01.2015)

Completed

Institute Funded

19. A study on modelling and forecasting of time-series with long memory processes.

    (AGENIASRISIL201300700008)

    Ranjit Kumar Paul, Himadri Ghosh and Bishal Gurung: 01.05.2013-30.04.2015

20. A study on STAR and SV families of nonlinear time-series models for describing cyclicity and volatility in Agriculture. (AGENIASRISIL20130080009)

    Bishal Gurung, Himadri Ghosh and Ranjit Kumar Paul: 21.05.2013-22.05.2015

Outside Funded

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

New Initiated

Institute Funded

22. A Study on price efficiency in agricultural commodity market. (AGENIASRISIL201500700044)

    SP Bhardwaj, Bishal Gurung and Kanchan Sinha: 13.05.2015-12.05.2017

23. Forecasting of spatio-temporal time series data using Space Time Autoregressive Moving Average (STARMA) model. (AGENIASRISIL202300060)

    Santosha Rathod, Mrinmoy Ray, Ajit, KN Singh and Bishal Gurung (from 20.09.2015): 20.08.2015-19.02.2018

24. Nonparametric bootstrap approach for constructing prediction intervals for non-linear and bivariate time series models. (AGENIASRISIL201502200059)

    Mrinmoy Ray, Santosha Rathod, Wasi Alam and KN Singh: 19.08.2015-18.08.2017

25. Development of hybrid time series models using machine learning techniques for forecasting crop yield with covariates. (AGENIASRISIL201502000057)

    Wasi Alam, Kanchan Sinha, Mrinmoy Ray, Santosha Rathod and KN Singh: 14.07.2015-13.01.2018

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

On-going

Institute Funded

26. Calibration estimators under two stage sampling design when study variable is inversely related to auxiliary variable. (AGENIASRISIL201400800027)

    Ankur Biswas, Kaustav Aditya and UC Sud: 01.05.2014-30.04.2016

Outside Funded

27. Development of innovative approches for small area estimation of crop yield, socio-economic and food insecurity parameters-under ICAR's Lal Bahadur Shastri Young Scientist award- 2012. (AGENIASRISOL201301800019)

    Hukum Chandra and Kaustav Aditya: 09.12.2013-08.12.2016

28. Study to test the developed alternative methodology for estimation of area and production of horticultural crops. IASRI component of CHAMAN program under MIDH, Funded by Department of Agriculture and Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India. (AGENIASRISOL201401700036)

    Tauqueer Ahmad, UC Sud, Prachi Misra Sahoo, Kaustava Aditya, AK Gupta and Ankur Biswas: 16.09.2014-15.06.2017

29. Pilot study for developing state level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanthan Committee Report. Funded by Directorate of Economics and Statistics, Department of Agriculture Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi. (AGENIASRISOL201500300040)

    UC Sud, Kaustava Aditya, Hukum Chandra, AK Gupta, Ankur Biswas, Vandita Kumari, Raju Kumar, Anshu Bhardwaj and Anil Kumar: 16.02.2015- 15.02.2017

Completed

Outside Funded

30. Pilot study for estimation of seed, feed and wastage ratios of major food grains. Funded by National Accounts Division, Central Statistics Office, MOS&PI, Government of India. (AGENIASRISOL201300900010)

UC Sud, KK Tyagi (till 30.09.2014), Hukum Chandra, Tauqueer Ahmad, VK Jain (till 31.10.2013), Kaustav Aditya, Prachi Misra Sahoo and Ankur Biswas: 01.07.2013-31.03.2016

New Initiated

Outside Funded

32. Investigation of causes of divergence between official and trade estimates of Jute production. Funded by Directorate of Economics & Statistics (DES), Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India. (AGENIASRISOL201502800065)

    Prachi Misra Sahoo, UC Sud, Tauqueer Ahmad, Ajit, Kaustav Aditya, Ankur Biswas: 01.09.2015-31.08.2017

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

On-going

Institute FundedI Annual Report 2014-15

33. Development of a tool for comparison of protein 3D structure using graph theoretic approach.

    (AGENIASRISIL201400500024)

    UB Angadi, KK Chaturvedi, Monendra Grover and Sudhir Srivastava (till 01.08.2015): 18.03.2014- 31.01.2017

34. Multilevel functional classification of abiotic stress related proteins in poaceae. (AGENIASRISIL201400600025)

    Monendra Grover, UB Angadi and Sudhir Srivastava (till 01.08.2015): 20.03.2014-14.08.2016

35. Estimation of breeding value using longitudinal data. (AGENIASRISIL201400700026)

    Upendra Kumar Pradhan, Prabina Kumar Meher, AR Rao and AK Paul: 23.04.2014-22.10.2016

36. Modelling and construction of transcriptional regulatory network using time-series gene expression data. (AGENIASRISIL201401100030)

    Samrendra Das, Bishal Gurung, Sanjeev Kumar and SD Wahi: 22.05.2014 – 21.11.2016

Outside Funded

37. Modelling network of gene responses to abiotic stress in rice. Funded by NFBSFARA, ICAR

    (AGENIASRICOL201300500006)

    IASRI: Sanjeev Kumar, Dinesh Kumar, Anil Rai, SB Lal and DC Mishra, NRCPB: Kishore Gaikwad, NK Singh and Vandana Rai, DRR: D Subramanyam, P Senguttuvel, DKMA: Himanshu, CDAC: Rajendra Joshi: 01.04.2013-31.03.2017

38. Whole genome sequencing and development of allied genomic research in two commercially important Fish-Labeo rohita and Clarias batrachus. Funded by DBT (AGENIASRISOL201301400015)

    IASRI: Dinesh Kumar, Sarika (w.e.f. 28.01.2014) and Mir Asif Iquebal (w.e.f. 28.01.2014), NBFGR: NS Nagpure (till 07.12.2015), Basdeo Kushwaha and Ravindra Kumar, CIFA: Paramananda Das, P Jayasankar and L Sahoo, Anand Agricultural University: Chaitanya G Joshi, PG Koringa: 10.09.2013-09.09.2016

39. Whole genome based SNP mining and development of breed signatures for dairy and dual-purpose indigenous cattle. Funded by DBT. (AGENIASRICOL201401600035)

    NBAGR, Karnal: Satpal Dixit, Jaya Kumar S, NDRI, Karnal: Ajay Kumar Dang, Avtar Singh, IASRI: Mir Asif Iquebal, Dinesh Kumar: 09.07.2014-08.07.2017

40. ICAR Network Project on Transgenics in Crops (NPTC). New Delhi

    (AGENIASRICOP201500400041)

    NRCPB: NK Singh (till 11.05.2015), TR Sharma (since 12.05.2015), IASRI: MA Iquebal, Sarika, Dinesh Kumar, Anil Rai: 27.01.2015-31.03.2017

Completed

Institute Funded

41. Development of statistical approach for prediction of eukaryotic splice sites. (AGENIASRISIL201301300014)

    Prabina Kumar Meher, SD Wahi and AR Rao: 03.09.2013-31.08.2015

42. Methodology for protein structure comparison and its web implementation. (AGENIASRISIL201300600007)

    Sudhir Srivastava, MNV Prasad Gajula (till 31.03.2014), DC Mishra and SB Lal (since 04.04.2014): 18.04.2013-17.04.2015

43. Bioinformatics approaches for data analysis and functional inferences in soil metagenome(s). (Collaboration with NBAIM, Mau). (AGENIASRICIP201401200031)

    NBAIM, Mau: DP Singh, Renu, Sunil Kumar, IASRI: Anil Rai, Sanjeev Kumar and Samir Farooqi: 01.07.2014-30.06.2017 (As per the recommendations of IRC (March 19-20, 2015) the project has been closed)

Outside Funded

44. Phenomics of moisture deficit and low temperature stress tolerance in rice (Funded by NRCPB, New Delhi). (COP1106)

    NRCPB: P Ananda Kumar, IARI: Viswanathan Chinnusamy, IASRI: Sudeep, SD Wahi, Alka Arora and AR Rao (w.e.f. 01.10.2013), IIT: S Chaudhury, University of Delhi: JP Khurana, CRRI, Cuttack: ON Singh, IGKV, Raipur: G Chandel, CAU, Barapani: Wricha Tyagi, ICAR RC-NEHR, Barapani: A Pattanaik: 15.02.2011–31.12.2015

45. A new distributed computing frame work for data mining. Funded by Department of Information Technology. (COP1222)

    BITS, Pilani: Navneet Goyal, Poonam Goyal and Sundar Balasubramaniam, IASRI: Sanjeev Kumar and Sudhir Srivastava (w.e.f. 02.05.2013-01.08.2015):15.10.2012–31.03.2016 (Association of IASRI w.e.f. 01.11.2012)

New Initiated

Institute Funded

46. Development of methodology for nonparametric modelling of time-series data and its application in agriculture. (AGENIASRISIL201500800045)

    Himadri Ghosh and Soumen Pal (October, 2015):06.06.2015-05.12.2017

47. Development of rank based stability measures for selecting genotypes. (AGENIASRISIL201502500062)

    Prakash Kumar, Amrit Kumar Paul, Samrendra Das and LM Bhar: 10.09.2015-31.08.2017

48. Gene Selection for Classification of Crop Gene Expression Data. (AGENIASRISIL201503000067)

    Samarendra Das, P K Meher, RK Paul and UK Pradhan: 20.10.2015-19.09.2018

49. A study on sequence encoding based approaches for splice site prediction in agricultural species. (AGENIASRISIL201603300070)

    Prabina Kumar Meher, UK Pradhan, SD Wahi and AR Rao: 01.01.2016-31.12.2017

Outside Funded

50. Computational identification and modelling of genetic variation in relation to performance traits in buffaloes. Funded by CABin. (AGENIASRICOP201500900046)

    CIRB, Hisar: Punam Sikka, KP Singh, SS Paul, A Jerome, S Balhara and Varij Nayan

    IASRI, New Delhi: Dwijesh Chandra Mishra, AR Rao and KK Chaturvedi: 06.06.2015-31.03.2017

51. Genomic data analysis for identification of economically important markers and viral diagnostics in pulses. Funded by CABin. (AGENIASRICOP201501000047)

    IIPR, Kanpur: Abhishek Bohra, Khela Ram Soren and Akram

    IASRI, New Delhi: MA Iquebal, Dinesh Kumar, Sarika and UB Angadi: 06.06.2015-31.03.2017

52. Computational approach for harnessing genome information and its integration with wheat phenome for efficient varietal development. Funded by CABin. (AGENIASRICOP201501200049) IIWBR, Karnal: Ratan Tiwari, Pradeep Sharma, Rajender Singh and Sonia Sheoran

    IASRI, New Delhi: Dinesh Kumar, MA Iquebal, Sarika and UB Angadi: 15.06.2015-31.03.2017

53. Mining and validation of candidate gene markers and screening on antimicrobial peptides of black pepper and small cardamom. Funded by CABin. (AGENIASRICOP201501100048)

    IISR, Kozhikode, Kerala: Johnson K Greorge, P Umadevi, KV Saji and Sharon Aravind

    IASRI, New Delhi: UB Angadi, Dinesh Kumar, MA Iquebal and Sarika: 15.06.2015-31.03.2017

54. Bioinformatic analysis of sequence data of brinjal and bitter gourd for identification of functional and regulatory genes for traits of economic importance. Funded by CABin. (AGENIASRICOP201501300050)

    NBPGR: KV Bhat, Soma S Marla, AB Gaikwad, S Archak and DP Wankhede

    IASRI: Monendra Grover and SB Lal: 16.06.2015-31.03.2017

55. Molecular and computational approach to delineate metabolic pathways for better carbohydrate utilization in Labeo spp. Funded by CABin. (AGENIASRICOP201501400051)

    CIFA, Bhubaneshwar: JK Sundaray, S Nandi, PK Maher, L Sahoo, KD Rasal, P Nandanpawar and UK Udit

    IASRI, New Delhi: Sarika, Dinesh Kumar, MA Iquebal and UB Angadi: 16.06.2015-31.03.2017

56. Elucidating the mechanism of Pashmina fibre development: An OMICS approach. Funded by National Agricultural Science Fund (NASF) (AGENIASRICOP201501500052)

    SKUAST-K: Nazir A Ganai

    IASRI, New Delhi AR Rao and PK Meher

    NDRI, Karnal: Jai K Kaushik: 01.07.2015-30.06.2018

57. Microbial domain research projects on computational aspects. Funded by CABin. (AGENIASRICOP201501600053)

    ICAR-NBAIM, Mau: DP Singh, Renu and Lalan Sharma

    ICAR-IASRI, New Delhi: Sanjeev Kumar, KK Chaturvedi and Samir Farooqi: 03.07.2015-31.03.2017

58. Development of database repertoire for Clostridium perfiringens strains prevalent in causing Enterotoxaemia in goats. Funded by CABin. (AGENIASRICOP201501700054)

    CIRG, Makhdoom: RVS. Pawaiya

    IASRI: AR Rao: 04.07.2015-31.03.2017

59. Development of database on SNPs associated with economically important traits of Indian goats. Funded by CABin. (AGENIASRICOP201501800055)

    CIRG, Makhdoom: RVS Pawaiya

    IASRI: AR Rao: 04.07.2015-31.03.2017

60. RiceMetaSys: Understanding rice gene network for blast resistance and drought tolerance through system biology approach. Funded by CABin. (AGENIASRICOP201501900056)

    NRCPB: Amol Kumar U Solanke, TR Sharma, Amitha SV Mithra and Ramawatar

    IASRI: Dwijesh Chandra Mishra and KK Chaturvedi: 08.07.2015-31.03.2017

61. Identification of genetic polymorphisms for pathogenicity in Vibrio sp. Funded by CABin. (AGENIASRICOP 201502100058) CIBA, Chennai: Ashok Kumar Jangam, SV Alavandi, K Vinaya Kumar, B Sivamani and Satheesha Avunje IASRI: Monendra Grover: 19.08.2015-31.03.2017

62. Computational and analytical solutions for high-throughput biological data. Funded by CABin. (AGENIASRISOL201502400061)

    Anil Rai, Dinesh Kumar, AR Rao, Monendra Grover, KK Chaturvedi, Sanjeev Kumar and Dwijesh Chandra Mishra:04.09.2015-31.03.2017

63. Metagenomic applications and transcriptomes profiling for inland aquatic environmental health surveillance. Funded by CABin. (AGENIASRICOP201502700064)

    ICAR-CIFRI, Barrackpore : BK Behera, ICAR-IASRI: AR Rao:01.09.2015-31.03.2017

64. Stochastic differential equation models and their applications to agriculture. Funded by Science and Engineering Research Board (SERB), New Delhi. (AGENIASRICOP201603400071)

    Ex. Emeritus Scientist, ICAR: Prajneshu

    ICAR-IASRI: Himadri Ghosh and Lal Mohan Bhar: 06.11.2015-05.11.2018

65. Network project on computational biology and agricultural bioinformatics under two sub-projects: Funded by CABin. (AGENIASRICOP201603500072): 26.11.2015-31.03.2017

    Sub-project 1:

Gene regulatory networks modeling for heat stress responses of sources and sink for development of climate smart Wheat.

ICAR-IARI: C Viswanathan, RR Kumar, Suneja Goswami, GP Singh, PK Singh, Neelu Jain and Puja Rai

ICAR-IASRI: DC Mishra, M Grover, Sanjeev Kumar and KK Chaturvedi

Sub-project 2:

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

ICAR-IARI: T Nepolean, MG Mallikarjuna and Shailendra K Jha

ICAR-IASRI: AR Rao and PK Meher

DEVELOPMENT OF INFORMATICS IN AGRICULTURAL RESEARCH

On-going

Institute Funded

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

    Sudeep, PK Malhotra (30.09.2014), RC Goyal (till 30.06.2013), Yogesh Gautam (till 15.08.2014) and Pal Singh (w.e.f. 01.10.2013): 01.04.2012– 31.03.2017

67. National Information System on Agricultural Education Network in India. (NISAGENET-IV). (SIX1217)

    RC Goyal (till 30.06.2013), Sudeep, Alka Arora, Pal Singh, Shashi Dahiya and Soumen Pal (till 30.09.2012) and Anshu Bhardwaj (since 01.10.2014): 01.04.2012–31.03.2017

68. Results framework document management system in ICAR (RFD-MS). (AGENIASRISIL201400900028)

    N Srinivasa Rao, Mukesh Kumar and AK Choubey: 09.05.2014-30.04.2017

69. Development of 16s rRNArumen specific microbes database. (Collaboration with NIANP, Bangalore) (AGENIASRICIP201401400033)

    NIANP, Bangalore: M Bagath and AP Kolte, IASRI: UB Angadi and Monendra Grover (since 21.11.2014): 23.07.2014-31.03.2017

70. Tobacco Agridaksh: An online expert system. (AGENIASRICIP201401800037)

    ICAR-CTRI, Rajahmundry: H Ravisankar, D Damodar Reddy, U Sreedhar, K Sivaraju, K Sarala, S Kasturi Krishna and M Anuradha, ICAR-IASRI: N Srinivasa Rao and Sudeep: 20.10.2014-20.10.2017

Completed

Institute Funded

71. Project information and management system of ICAR (PIMS-ICAR). (SIX0901)

    RC Goyal (till 30.06.2013), Pal Singh, PK Malhotra (till 30.09.2014), Sudeep and Alka Arora: 01.01.2009–30.09.2015

72. Development of web based mushroom expert system. (CIP1110)

    DMR, Solan: Mahantesh Shirur (till 30.09.2012), K Manikandan (from 01.10.2012 to July 2014), B Vijay, RC Upadhyay, VP Sharma, OP Ahlawat, Satish Kumar, Shwet Kamal and Goraksha C Wokchaure, IASRI: Sudeep (w.e.f. 01.10.2013), Yogesh Gautam (w.e.f. 01.10.2011), Pal Singh, Hari Om Agarwal (till 29.02.2012) and Harnam Singh (till 01.02.2012): 01.04.2011–31.03.2015

73. Strengthening and refinement of maize AgriDaksh. (CIP1113)

    DMR: Virendra Kumar Yadav (till June 2014), KP Singh (from July 2014), P Kumar, Vinay Mahajan, KS Hooda, Jyoti Kaul, Ashok Kumar, Aditya Kumar Singh, Ishwar Singh, Meena Shekhar, DP Choudhary, Avinash Singode, CM Parihar, Chikkappa G Karjagi, and Ambika Rajendran; IASRI: Sudeep (w.e.f. 01.03.2012), Yogesh Gautam (w.e.f. 01.10.2011), Pal Singh, Hari Om Agarwal (till 29.02.2012) and Harnam Singh Sikarwar (till 01.02.2012), NS Rao (from 01.10.2014): 01.04.2011–31.03.2016

74. Development and application of electronic learning and diagnostic modules for health management of dogs. (Collaboration with IVRI, Izatnagar) (AGENIASRICIP201401300032)

    IVRI, Izatnagar: Rupasi Tiwari, MC Sharma, BP Singh, Yash Pal and KK Mishra

    IASRI, New Delhi: Mukesh Kumar: 01.07.2014-31.12.2015

New Initiated

Institute Funded

75. Developing a comprehensive web based system for agriculturally important microbes. Collaboration with NBAIM, Mau. (AGENIASRICIP201500500042)

    SN Islam, Anshu Bharadwaj and N Srinivasa Rao: 01.04.2015-31.03.2017

76. Implementation of ICAR-ERP, unified communication and web hosting solution. (AGENIASRISIL201500600043)

    AK Choubey, Alka Arora, Sudeep, N Srinivasa Rao, Mukesh Kumar, SN Islam, Anshu Bhardwaj and Sangeeta Ahuja: 10.04.2015-09.04.2018

77. Cluster ensemble algorithms for germplasms evaluation on Chickpea. (AGENIASRISIL201502600063) IASRI: Sangeeta Ahuja and AK Choubey

    NCIPM: OP Sharma NBPGR: HL Raiger: 18.09.2015-17.09.2016

Extramural Projects

78. Transcriptome and proteome analysis for identification of candidate genes responsible for pistillate nature in castor. Funded by Extramural funded under Crop Sciences Division. (AGENIASRICOP201603600073)

    IIOR: M Sujatha

    ICAR-IASRI: MA Iquebal: 21.01.2016-31.03.2017

79. Knowledge management system for agriculture extension services in Indian NARES. Funded by Extramural funded under Agricultural Extension Division, ICAR. (AGENIASRICOL201603700074) ICAR-IASRI: Alka Arora, AK Choubey, NS Rao, SN Islam, Soumen Pal and Sudeep

    Agricultural Extension Division, ICAR. : P Adiguru: 04.03.2016-31.03.2017

Consultancy Project

80. Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping. Funded by Food and Agriculture Organization (FAO) of the United Nations.

    UC Sud, Tauqueer Ahmad, Hukum Chandra, Prachi Misra Sahoo, Kaustav Aditya, Ankur Biswas, Man Singh, GM Pathak and Neelam Chandra: 18.12.2014-17.10.2016

81. Testing and validation of alternative methodology developed by IASRI for estimation of area and production of horticultural crops in Madhya Pradesh State. Tauqueer Ahmad UC Sud, Prachi Misra Sahoo, Anil Rai, Kaustav Aditya, Raju Kumar and Man Singh: 01.06.2015-28.02.2018

82. Testing and validation of alternative methodology developed by IASRI for estimation of area and production of horticultural crops in Haryana State. Tauqueer Ahmad, UC Sud, Prachi Misra Sahoo, Anil Rai, Ankur Biswas, Vandita Kumari, Man Singh, GM Pathak and Neelam Chandra : 06.08.2015-05.05.2018

83. Development of software for data entry and undertaking, analysis of data for storage losses in FCI/CWC godowns. Sangeeta Ahuja, AK Choubey and Anil Rai: 15.10.2015-31.03.2016

National Fellow Scheme

84. Robust and efficient small area estimation methods for agricultural and socio-economic surveys and their application in Indo-Gangetic plain. Hukum Chandra: 25.11.2014-24.11.2019

Annexure-II

ICAR-IASRI PERSONNEL

Director
Dr. UC Sud

National Professor (on Strength of ICAR)
Dr. VK Gupta (till 16.03.2016)

Head, Division of Design of Experiments
Dr. Seema Jaggi (A)

Head, Division of Sample Surveys
Dr. UC Sud (till 27.05.2015)
Dr. AK Gupta (28.05.2016 to 10.03.2016)
Dr. Tauqeer Ahmad (w.e.f. 11.03.2016)

Head, Division of Statistical Genetics
Dr. Lalmohan Bhar

Head, Division of Forecasting & Agricultural Systems Modeling
Dr. KN Singh

Head, Division of Computer Application
Dr. AK Chaubey

Head, Centre for Agricultural Bioinformatics
Dr. Anil Rai

Professor (Agricultural Statistics)
Dr. Seema Jaggi

Professor (Computer Application)
Dr. Seema Jaggi

HRD Nodal Officer
Dr. Seema Jaggi

Professor (Bioinformatics)
Dr. Anil Rai

Warden, Sukhatme Hostel
Dr. AK Chaubey

Incharge, Prioritization, Monitoring & Evaluation (PME) Cell
Dr. Ajit

Vigilance Officer
Dr. UC Sud (till 21.04.2015)
Dr. LM Bhar (w.e.f. 22.04.2015)

Transparency Officer & Nodal Officer, RTI
Sh. SD Wahi

Welfare Officer
Dr. SP Bhardwaj

Incharge, National Agricultural Science Museum
Sh. Pal Singh

Senior Administrative Officer & Head of Office
Sh. Suresh Kumar Gajmoti
Sr. Finance and Accounts Officer
Sh. AP Sharma

Library
Dr. Anil Rai, Incharge
Sh. SPS Hans, Librarian

Public Information Officer
Sh. AK Manchanda (till 15.11.2015)
Sh. Chander Vallabh (w.e.f. 16.11.2015)

Annexure-III

VARIOUS COMMITTEES

Consultancy Processing Cell (CPC)

1. Dr. Rajender Parsad, Principal Scientist	Chairman
2. Dr. Seema Jaggi, Principal Scientist and Head, DE	Member
3. Dr. Anil Kumar, Principal Scientist	Member
4. Dr. Tauqueer Ahmad, Principal Scientist	Member
5. Dr. Ajit, Principal Scientist & Incharge, PME Cell	Member
6. Senior Finance and Accounts Officer (Ex-Officio)	Member
7. Head of Office (Ex-Officio)	Member
8. Sh. PP Singh, Chief Technical Officer	Member-Secretary

Institute Technology Management Committee (ITMC)

1. Dr. UC Sud, Director	Chairman
2. Dr. Anil Rai, HD (CABin) (Technical Expert – A Scientist of the Institute)	Member
3. Dr. LM Bhar, Head, Statistical Genetics	Member(w.e.f. 09 May 2015)
4. Dr. KS Rana, Professor and Head of Division of Agronomy (IPR Expert – A Scientist from ICAR Institute in the Zone)	Member
5. Dr. Seema Jaggi, Principal Scientist Head, DE (Technical Expert – A Scientist of the Institute)	Member
6. Dr. Rajender Parsad,Principal Scientist & Incharge, ITMU	Member–Secretary

Institute Technology Management Unit (ITMU)

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

Institute Results-Framework Document (RFD) Committee

1. Director	Chairman
2. Dr. Anil Rai, Head (CABin)	RFD Nodal Officer & Member Secretary
3. Dr. AK Mogha, Chief Technical Officer	RFD Co-Nodal Officer
4. All Heads of Divisions	Member
5. Incharge, PME Cell	Member
6. Professor (Agricultural Statistics)	Member
7. Professor (Computer Application)	Member
8. Professor (Bioinformatics)	Member
9. Chief Administrative Officer	Member
10. Senior Finance & Accounts Officer	Member

RFD Cell of the Institute

1. Dr. UC Sud, Director	Chairman
2. Dr. Anil Rai, Head (CABin) & RFD Nodal Officer	Member
3. Dr. AK Mogha, Chief Technical Officer	Member

Institute Deputation Committee

1. Director	Chairman
2. All Heads of Divisions	Member
3. Senior Administrative Officer	Member
4. Sr. Finance & Accounts Officer	Member
5. Incharge, PME Cell	Member Secretary

Project Monitoring Committee (PMC)

1. Director	Chairman
2. All Heads of Divisions	Member
3. Incharge, PME Cell	Member Secretary

Institute Joint Staff Council

Official Side Members

1. Dr. UC Sud, Director	Chairman
2. Dr. AK Chaubey, Head (CA)	Member
3. Dr. Ajit, Principal Scientist	Member
4. Sh. SD Wahi, Principal Scientist	Member
5. Dr. SP Bharadwaj, Principal Scientist	Member
6. Sh. AP Sharma, Sr. F&AO	Member
7. Sh. SK Gajmoti, Head of Office	Member Secretary

Staff Side Members

1. Sh. KB Sharma, Assistant	Secretary
2. Sh. Krishan Kumar, Assistant	Member
3. Sh. Mohan Singh, Technical Officer	Member
4. Sh. Hari Lal, Driver	Member
5. Sh. Ashok Kumar, SSS	Member
6. Sh. Janak Kumar, SSS	Member

Grievance Committee

Official Side Members

1. Dr. UC Sud, Director	Chairman
2. Dr. AK Chaubey, Head (CA)	Member
3. Sh. SK Gajmoti, Head of Office	Member
4. Sh. AP Sharma, Sr. F&AO	Member
4 Assistant Administrative Officer (Admn. II)	Member Secretary

Staff Side Members

1. Sh. Pal Singh, Scientist	Member, Scientific Group
2. Sh. Satya Pal Singh, Sr. Technical Officer	Member, Technical Group
3. Sh. Basant Kumar, Assistant	Member, Administrative Group
4. Sh. Viveka Nand, SSS	Member, Skilled Supporting Staff Group

ICAR Staff Welfare Fund Scheme

1. Dr. UC Sud, Director	Chairman
2. Dr. SP Bharadwaj, Principal Scientist	Welfare Officer
3. Sh. SK Gajmoti, Head of Office	Member
4. Sh. AP Sharma, Sr. F&AO	Member
5. Dr. Seema Jaggi, Principal Scientist	Female Member
6. Sh. KB Sharma, Secretary, IJSC(SS)	Member
7. Sh. Mahender Pandit, Member IGC	Member
8. AAO, Admn-II	Member Secretary

Women Cell

1. Dr. Seema Jaggi, Principal Scientist	Chairperson
2. Dr. Cini Varghese, Principal Scientist	Member
3. Ms. Vijay Bindal, Chief Technical Officer	Member
4. Smt. Suman Khanna, Stenographer	Member
5. Smt. Poonam Singh, Administrative Officer	Convener

Canteen Committee

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

International Training Hostel (ITH)/Panse Guest House

Dr. Anil Kumar, Principal Scientist is the Incharge and Sh. Diwan Singh is the Caretaker of the Guest Houses. A total of 1308 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 1342 guests stayed at Panse Guest House during the period under report.

Hostel Executive Committee

1. Warden	Dr. AK Chaubey
2. Prefect	Sh. Saurav Guha
3. Mess Secretary cum Assistant Prefect	Sh. Shyam Sundar Parui
4. Cashier	Sh. Rahul Banerjee
5. Maintainance Sectretary	Sh. Sumeet Sourav
6. Sports Secretary	Sh. Nitin Varshney Sh. Subhrajit Satpathy
7. Cultural Secretary	Sh. PN Somanna Sh. Amit Saha Sh. Parvej Mallik
8. Gym Secretary	Sh. Chiranjib Sarkar Sh. Sreekumar Biswas
9. Health Secretary	Sh. Nobin Chandra Pal
10. Magazine Secretary	Sh. Rajeev Kumar Sh. Nalinikant Chaudhari

11. Common Room Secretary	Sh. Sushil Kumar Sh. Prakash Lakra
12. Communication Secretary	Sh. Anubhav Roy Sh. Kuldeep Aswal
13. Auditors	Sh. Amit Kairi Sh. Pradip Basak Sh. Rajeev Ranjan Md. Ashraful
14. Dinning Hall Committee	Md. Asif
15. Panse Guest House Representative	Md. Harun
16. Warden's Nominee	Sh. Achal Lama

Institute Recreation Club

1. Dr. UC Sud, Director	President
2. Dr. KN Singh, Head of Division	Vice President
3. Sh. SK Gajmoti, Head of Office	Member
4. Sh. AP Sharma, Sr. F&AO	Member
5. Sh. Raj Kumar Verma, Assistant	Member
6. Sh. Mayank Pundeey, Assistant	Secretary
7. Sh. Dharmendra Tanwar, LDC	Treasurer
8. Smt. Vijay Laxmi Murthy, PA	Lady Member

Institute Sports Committee

1. Dr. UC Sud, Director	President
2. Dr. KN Singh, Head of Division	Vice President
3. Sh. SK Gajmoti, Head of Office	Member
4. Sh. AP Sharma, Sr. F&AO	Member
5. Dr. Susheel Kumar Sarkar, Scientist	Member
6. Sh. RS Tomar, Assistant Chief Technical Officer	Member
7. Sh. Chander Vallabh, AAO	Member
8. Sh. KB Sharma, Assistant & Secretary, IJSC	Member
9. Smt. Vijay Laxmi Murthy, PA	Lady Member

IASRI Employees Co-operative Thrift and Credit Society Limited

1. Dr. UC Sud, Director	Patron
2. Sh. Ram Naresh	President
3. Sh. BJ Gahlot	Vice-President
4. Sh. SP Singh	Secretary
5. Sh. Sunil Bhatia	Treasurer
6. Sh. VP Singh	Member
7. Sh. Ashok Kumar	Member
8. Sh. Sukanta Dash	Member
9. Sh. Dinesh Kumar Rai	Member
10. Sh. MM Mourya	Member
11. Dr. Sarika	Member
12. Dr. Anshu Bhardwaj	Member

Annexure-IV

NATIONAL AGRICULTURAL SCIENCE MUSEUM (NASM)

National Agricultural Science Museum (NASM) was conceived by the ICAR and executed by the National Council of Science Museums (NCSM), Ministry of Culture, Government of India during 2004. The responsibility of up-keep and maintenance of NASM rests with ICAR-Indian Agricultural Statistics Research Institute, Pusa, New Delhi. NASM is situated at NASC Complex, DPS Marg, Opposite Dasghara Village, Pusa Campus, New Delhi.

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

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

Management Committee for Modernization/Strengthening of the National Agricultural Science Museum (NASM)

Dr. Alagusundaram, DDG(Engg.), ICAR	Chairman
Dr. Kanchan K Singh, ADG(FE), ICAR	Member
Dr. AK Vasisht, ADG(PIM&ESM), ICAR	Member
Dr. UC Sud, Director, IASRI	Member
Sh. SK Mitra, Director (GAC), ICAR	Member
Sh. Pal Singh, Incharge, NASM	Member Secretary

Newly constituted Management Committee for Modernization/Strengthening of the National Agricultural Science Museum (NASM)

Dr. K Alagusundaram, DDG(Engg.), ICAR	Chairman
Dr. Kanchan K Singh, ADG(FE), ICAR	Member
Dr. AK Vasisht, ADG(PIM&ESM), ICAR	Member
Sh. Puspendra Kumar, Deputy Secretary (GAC), ICAR	Member
Sh. Devendra Kumar, Director Finance, ICAR	Member
Dr. UC Sud, Director, IASRI	Member
Sh. VP Kotyal Director (Works), ICAR	Member Secretary

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

Dr. UC Sud, Director, IASRI	Chairman
Dr. AK Choubey, Head (CA), IASRI	Member
Sh. AP Sharma, Sr. F&AO, IASRI	Member
Sh. SK Gajmoti, Head of Office, IASRI	Member
Sh. Pal Singh, Scientist & Incharge, NASM	Member Secretary

Under the guidance of above Committees, the activities of the Museum relating to up-keep and maintenance are looked after by Sh. Pal Singh, Scientist & Incharge NASM with Technical Officers and administrative staff of IASRI. The fully air-conditioned Museum remains open to visitors on all days from 10:30 hrs. to 16:30 hrs. except Monday (weekly holiday). There is a nominal fee of Rs. 10/- per head but the groups of farmers, children from schools/colleges are exempted from entrance fee. NASM is listed at the website of Delhi Government and can be accessed through http://www.delhitourism.gov.in/delhitourism/entertainment/museum_in_delhi.jsp. General Information about museum is available at http://www.icar.org.in/en/node/306 and virtual tour of museum is also available at http://www.icar.org.in/en/node/2095

During the year 2015-16 from April,2015 to March,2016 44333 visitors visited NASM and 2967 tickets were sold. Students from 110 school of Delhi/NCR, Students from University of 14 States and farmers from 11 States of India visited the NASM. Trainees from different training programmes conducted by ICAR institute and many important delegation visited NASM.

National Agricultural Science Museum (NASM) participated in the Krishi Unnati mela held at IARI, New Delhi during March 19-21 March,2016. A Documentary films on Green Revolution, Agricultural festival & Indigo Cultivation of India were shown through plasma . Posters of NASM exhibits and India's position in the world of different commodities were also demonstrated to the general visitors, researcher, students and farmers to give them adequate knowledge about NASM. More than 561 visitors including students, farmers Govt and non govt. agencies visited NASM Stall.

Annexure-V

Results-Framework Document (RFD)

for

ICAR-Indian Agricultural Statistics Research Institute

(2014-2015)

Address
Library Avenue, Pusa, New Delhi- 110 012

Website
http://www.iasri.res.in

Section 1: Vision, Mission, Objectives and Functions

Vision

Statistics and Informatics for enriching the quality of Agricultural Research.

Mission

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

Objectives

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

Functions

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

Section 2: Inter se-priorities among key Objectives, Success Indicators and Targets

Sl. No.	Objective(s)	Weight	Action(s)	Success Indicator(s)	Unit	Weight	Target/Criteria Value				
							Excellent	Very Good	Good	Fair	Poor
							100%	90%	80%	70%	60%
01	To develop statistical methodologies for improving the quality of agricultural research	45	Development of efficient statistical techniques	Methodologies developed for design of experiments/ forecasting/sample surveys/ statistical genetics/bio-informatics	Number	35	10	8	6	4	2
			Statistical and computational support for agricultural research	Tools and techniques provided	Number	10	6	5	4	3	2
02	To develop informatics for enhancing efficiency of the system	10	Development of Information System/ Decision Support System/ Expert System/ Software	Software developed	Number	10	3	2	1	0	0
03	To develop globally competitive human resources	25	Conducting M.Sc. and Ph.D. programmes	Degree awarded	Number	13	17	16	15	13	12
			Organization of training programmes	Training programmes conducted	Number	12	12	10	8	6	4
*	Publication/ Documentation	5	Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Research articles published	No.	3	40	35	30	25	20
			Timely publication of the Institute Annual Report (2013-2014)	Annual Report published	Date	2	30.06.2014	02.07.2014	04.07.2014	07.07.2014	09.07.2014
*	Fiscal resource management	2	Utilization of released plan fund	Plan fund utilized	%	2	98	96	94	92	90
*	Efficient Functioning of the RFD System	3	Timely submission of Draft RFD for 2014-2015 for Approval	On-time submission	Date	2	May 15, 2014	May 16, 2014	May 19, 2014	May 20, 2014	May 21, 2014
			Timely submission of Results for 2013-2014	On-time submission	Date	1	May 1 2014	May 2 2014	May 5 2014	May 6 2014	May 7 2014
*	Enhanced Transparency / Improved Service delivery of Ministry/ Department	3	Rating from Independent Audit of implementation of Citizens' / Clients' Charter (CCC)	Degree of implementation of commitments in CCC	%	2	100	95	90	85	80
			Independent Audit of implementation of Grievance Redress Management (GRM) system	Degree of success in implementing GRM	%	1	100	95	90	85	80
*	Administrative Reforms	7	Update organizational strategy to align with revised priorities	Date	Date	2	Nov.1 2014	Nov.2 2014	Nov.3 2014	Nov.4 2014	Nov.5 2014
			Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC)	% of Implementation	%	1	100	90	80	70	60
			Implementation of agreed milestones for ISO 9001	% of implementation	%	2	100	95	90	85	80
			Implementation of milestones of approved Innovation Action Plans (IAPs)	% of implementation	%	2	100	90	80	70	60

Section 3: Trend Values of the Success Indicators

Sl. No.	Objectives	Actions	Success Indicators	Unit	Actual value for FY 12/13	Actual value for FY 13/14	Target value for FY 14/15	Projected value for FY 15/16	Projected value for FY 16/17
01	To develop statistical methodologies for improving the quality of agricultural research	Development of efficient statistical techniques	Methodologies developed for design of experiments/ forecasting/sample surveys/ statistical genetics/bio-informatics	Number	8	9	8	9	9
		Statistical and computational support for agricultural research	Tools and techniques provided	Number	5	5	5	5	5
02	To develop informatics for enhancing efficiency of the system	Development of Information System/ Decision Support System/Expert System/Software	Software developed	Number	2	3	2	2	2
03	To develop globally competitive human resources	Conducting M.Sc. and Ph.D. programmes	Degree awarded	Number	15	16	16	17	17
		Organization of training programmes	Training programmes conducted	Number	13	12	10	11	11
*	Publication/ Documentation	Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Research articles published	Number	43	45	35	35	35
		Timely publication of the Institute Annual Report (2013-2014)	Annual Report published	Date	-	-	02.07.2014	-	-
*	Fiscal resource management	Utilization of released plan fund	Plan fund utilized	%	88	99	96	96	96
*	Efficient Functioning of the RFD System	Timely submission of Draft RFD for 2014-2015 for Approval	On-time submission	Date	-	-	May 16, 2014	-	-
		Timely submission of Results for 2013-2014	On-time submission	Date	-	-	May 2, 2014	-	-
*	Enhanced Transparency/ Improved Service delivery of Ministry/ Department	Rating from Independent Audit of implementation of Citizens' / Clients' Charter (CCC)	Degree of implementation of commitments in CCC	%	-	-	95	-	-
		Independent Audit of implementation of Grievance Redress Management (GRM) system	Degree of success in implementing GRM	%	-	-	95	-	-
*	Administrative Reforms	Update organizational strategy to align with revised priorities	Date	Date	-	-	Nov.2, 2014	-	-
		Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC)	% of Implementation	%	-	-	90	-	-
		Implementation of agreed milestones for ISO 9001	% of implementation	%	-	-	95	-	-
		Implementation of milestones of approved Innovation Action Plans (IAPs)	% of implementation	%	-	-	90	-	-

SECTION 4 (a) : Acronym

Sl. No.	Acronym	Description
1.	PG	Post Graduate
2.	AICRPs	All India Coordinated Research Projects
3.	M. Sc.	Master of Science
4.	Ph. D.	Doctor of Philosophy
5.	SAUs	State Agricultural Universities
6.	MoSPI	Ministry of Statistics and Programme Implementation
7.	DoAC	Department of Agriculture and Cooperation
8.	DADF	Department of Animal Husbandry, Dairying and Fisheries

SECTION 4 (b): Description and definition of success indicators and proposed measurement methodology

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

Section 5: Specific performance requirements from other Departments that are critical for delivering agreed results

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

Section 6: Outcome / Impact of activities of Department/Ministry

Sl. No.	Outcome / Impact	Jointly responsible for influencing this outcome/ impact with the following organization(s)/ department(s)/ ministry(ies)	Success Indicator(s)	Unit	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
1.	Enhancing efficiency through statistical/ computational tools and informatics	SAUs/AICRPs/MoSPI/DoAC/ DADF	Increase in usage of methodologies/ tools and accessibility of information	%	5	5	5	5	5
			Research papers published	Number	96	105	100	100	100
2.	Enhancing availability of quality human resource	SAUs, Central and State Govt. Officials	Successful completion of degree programme and employability of the students	% passed out	80	94	88	90	92

Annual (April 1, 2014 to March 31, 2015) Performance Evaluation Report in respect of RFD 2014-2015 of RSCs i.e. Institutes

Annexure-VI

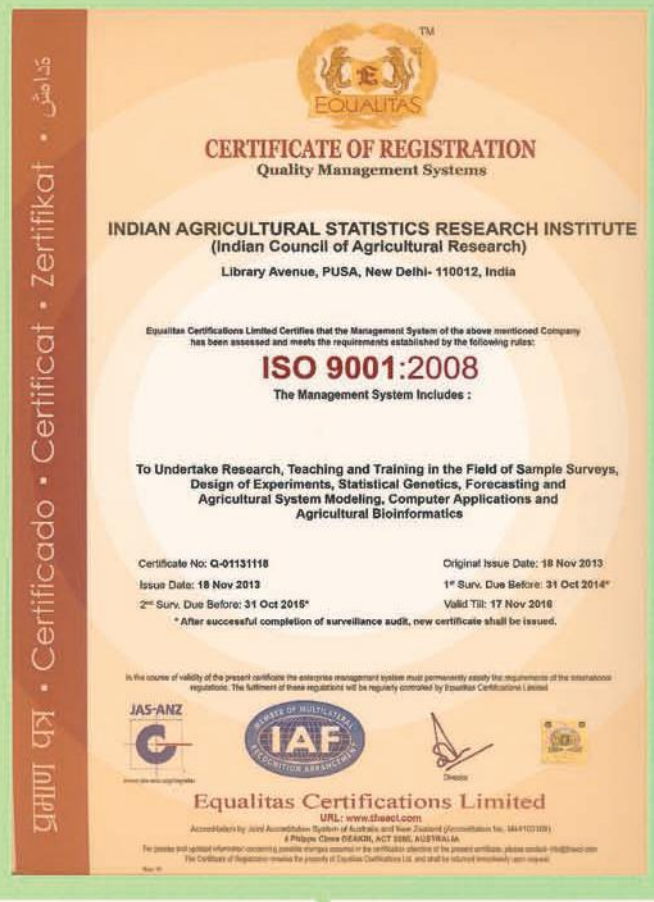
Name of the Division: Agricultural Engineering

Name of the Institution: ICAR-Indian Agricultural Statistics Research Institute

RFD Nodal Officer: Dr Anil Rai

S. No.	Objectives	Weight (%)	Actions	Success Indicators	Unit	Weight (%)	Target/Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.	Reasons for shortfalls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw Score	Weighted Score		
	To develop statistical methodologies for improving the quality of agricultural research	45	Development of efficient statistical techniques	Methodologies developed for design of experiments/ forecasting/ sample surveys/ statistical genetics/ bio-informatics	Number	35	10	8	6	4	2	10	100	35	125.0	Excellent Target achieved
			Statistical and computational support for agricultural research	Tools and techniques provided	Number	10	6	5	4	3	2	7	100	10	140.0	Excellent Target achieved
	To develop informatics for enhancing efficiency of the system	10	Development of Information System/ Decision Support System/Expert System/Software	Software developed	Number	10	3	2	1	0	0	3	100	10	150.0	Excellent Target achieved
3	To develop globally competitive human resources	25	Conducting M.Sc. and Ph.D. programmes	Degree awarded	Number	13	17	16	15	13	12	18	100	13	112.5	Excellent Target achieved
			Organization of training programmes	Training programmes conducted	Number	12	12	10	8	6	4	12	100	12	120.0	Excellent Target achieved
*	Publication/ Documentation	5	Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Research articles published	Number	3	40	35	30	25	20	53	100	3	151.4	Excellent Target achieved

			Timely publication of the Institute Annual Report (2013-2014)	Annual Report published	Date	2	30.06.2014	02.07.2014	04.07.2014	07.07.2014	09.07.2014	30/06/14	100	2	-	-
*	Fiscal resource management	2	Utilization of released plan fund	Plan fund utilized	%	2	98	96	94	92	90	99	100	2	-	-
*	Efficient Functioning of the RFD System	3	Timely submission of Draft RFD for 2014-2015 for Approval	On-time submission	Date	2	May 15, 2014	May 16, 2014	May 19, 2014	May 20, 2014	May 21, 2014	05/05/14	100	2	-	-
			Timely submission of Results for 2013-2014	On-time submission	Date	1	May 1 2014	May 2 2014	May 5 2014	May 6 2014	May 7 2014	23/04/14	100	1	-	-
*	Enhanced Transparency / Improved Service delivery of Ministry/ Department	3	Rating from Independent Audit of implementation of Citizens' / Clients' Charter (CCC)	Degree of implementation of commitments in CCC	%	2	100	95	90	85	80	100	100	2	-	-
			Independent Audit of implementation of Grievance Redress Management (GRM) system	Degree of success in implementing GRM	%	1	100	95	90	85	80	100	100	01	-	-
*	Administrative Reforms	7	Update organizational strategy to align with revised priorities	Date	Date	2	Nov.1 2014	Nov.2 2014	Nov.3 2014	Nov.4 2014	Nov.5 2014	30/10/2014	100	02	-	-
			Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC).	% of Implementation	%	1	100	90	80	70	60	80	80	0.8	-	-
			Implementation of agreed milestones for ISO 9001	% of implementation	%	2	100	95	90	85	80	100	100	02	-	-
			Implementation of milestones of approved Innovation Action Plans (IAPs).	% of implementation	%	2	100	90	80	70	60	60	60	1.2	-	-
													Total Composite Score		99.0	
													Rating		Excellent	



EQUALITAS

CERTIFICATE OF REGISTRATION
Quality Management Systems

INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
Library Avenue, PUSA, New Delhi- 110012, India

Equalitas Certifications Limited Certifies that the Management System of the above mentioned Company has been assessed and meets the requirements established by the following rules:

ISO 9001:2008
The Management System Includes :

To Undertake Research, Teaching and Training in the Field of Sample Surveys, Design of Experiments, Statistical Genetics, Forecasting and Agricultural System Modeling, Computer Applications and Agricultural Bioinformatics

Certificate No: Q-01131118
Original Issue Date: 18 Nov 2013
Issue Date: 18 Nov 2013
1st Surv. Due Before: 31 Oct 2014*
2nd Surv. Due Before: 31 Oct 2015*
Valid Till: 17 Nov 2016
* After successful completion of surveillance audit, new certificate shall be issued.

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

JAS-ANZ
IAF
Chassis

Equalitas Certifications Limited
URL: www.theeci.com
Accreditation by Joint Accreditation System of Australia and New Zealand (Accreditation No. 4641)
6 Prilaye Close DEAKIN, ACT 2600, AUSTRALIA
For precise and updated information concerning possible changes occurred in the certification objective of the present certificate, please contact: info@theeci.com
The Certificate of Registration remains the property of Equalitas Certifications Ltd. and shall be returned immediately upon request.

Rev. 01

---

bsi.

By Royal Charter

Certificate of Registration

INFORMATION SECURITY MANAGEMENT SYSTEM - ISO/IEC 27001:2013

This is to certify that:
ICAR Data Center
Division of Computer Application,
Computer Center
ICAR - Indian Agricultural Statistics
Research Institute
Pusa
Delhi 110 012
India

Holds Certificate No: **IS 622589**

and operates an Information Security Management System which complies with the requirements of ISO/IEC 27001:2013 for the following scope:

The Information Security Management System applies to operations & maintenance including support function activities of ICAR Data Center Built and Managed by ICAR-Indian Agricultural Statistics Research Institute at New Delhi.
This is in accordance with the Statement of Applicability Ver. 1.1, dated 5th Oct 2015.
(This Registration covers the activities delivered at the location as shown on page 2 of this Certificate)

For and on behalf of BSI:
Chris Cheung, Head of Compliance & Risk - Asia Pacific

Original Registration Date: 14/10/2015
Latest Revision Date: 14/10/2015
Effective Date: 14/10/2015
Expiry Date: 06/10/2018

Page: 1 of 2

...making excellence a habit.

ANAB

This certificate was issued electronically and remains the property of BSI and is bound by the conditions of contract.
An electronic certificate can be authenticated online.
Printed copies can be validated at www.bsigroup.com/ClientDirectory or telephone +91 11 2692 9000.
Further clarifications regarding the scope of this certificate and the applicability of ISO/IEC 27001:2013 requirements may be obtained by consulting the organization.
This certificate is valid only if provided original copies are in complete set.

Information and Contact: BSI, Kitemark Court, Davy Avenue, Knaphill, Woking Surrey GU21 2RP Tel: + 44 845 080 9000
BSI Assurance UK Limited, registered in England under number 7805321 at 389 Chiswick High Road, London W4 4AL, UK.
A Member of the BSI Group of Companies.

---

bsi.

By Royal Charter

Certificate of Registration

IT SERVICE MANAGEMENT SYSTEM - ISO/IEC 20000-1:2011

This is to certify that:
ICAR Data Center
Division of Computer Application,
Computer Center
ICAR - Indian Agricultural Statistics
Research Institute
Pusa
Delhi 110 012
India

Holds Certificate No: **ITMS 622590**

and operates an IT Service Management System which complies with the requirements of ISO/IEC 20000-1:2011 for the following scope:

The Information Technology Service Management System of ICAR Data Centre applies to Data Centre Operations, Maintenance & Support function activities including IP Networks, Servers, Database, Storage, Backup, Helpdesk, Non-IT Support, Unified Messaging & Web Hosting Solution to ICAR User Departments & Institutions.
This is as per the latest Service Catalogue.

For and on behalf of BSI:
Chris Cheung, Head of Compliance & Risk - Asia Pacific

Original Registration Date: 14/10/2015
Latest Revision Date: 14/10/2015
Effective Date: 14/10/2015
Expiry Date: 06/10/2018

Page: 1 of 2

...making excellence a habit.

ANAB

This certificate was issued electronically and remains the property of BSI and is bound by the conditions of contract.
An electronic certificate can be authenticated online.
Printed copies can be validated at www.bsigroup.com/ClientDirectory or telephone +91 11 2692 9000.
Further clarifications regarding the scope of this certificate and the applicability of ISO/IEC 20000-1:2011 requirements may be obtained by consulting the organization.
This certificate is valid only if provided original copies are in complete set.

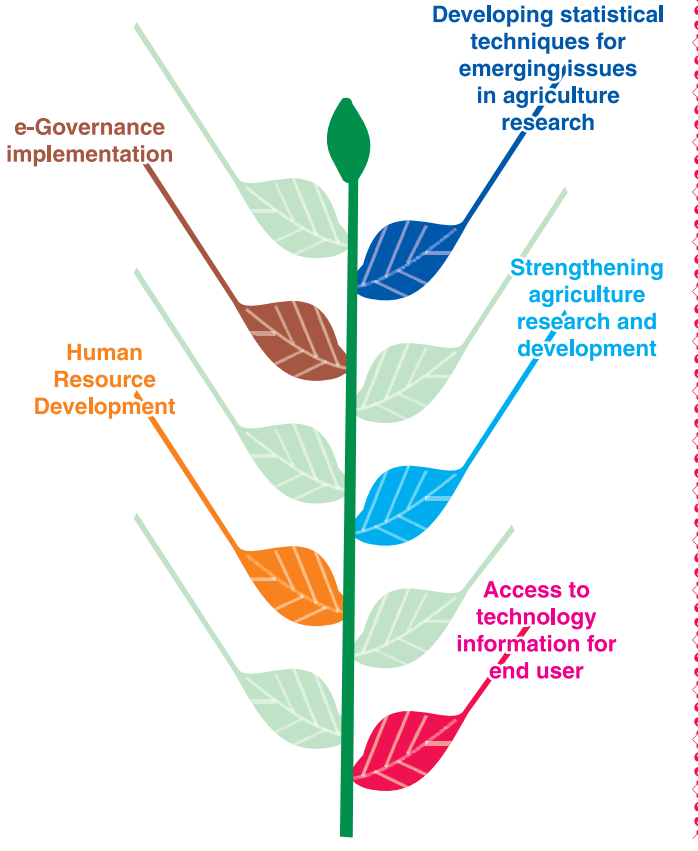
Information and Contact: BSI, Kitemark Court, Davy Avenue, Knaphill, Woking Surrey GU21 2RP Tel: + 44 845 080 9000
BSI Assurance UK Limited, registered in England under number 7805321 at 389 Chiswick High Road, London W4 4AL, UK.
A Member of the BSI Group of Companies.

Typeset & Printed by: Royal Offset Printers, A-89/1, Naraina Industrial Area, Phase -I, New Delhi-110028

Combating the Challenges

At ICAR-IASRI, we are attempting to respond the challenges for supporting the agriculture research and development in the country in the changing global scenario. We have seeded several initiatives and projects that have started fruiting. An ongoing focus on continuous improvement is helping us innovate to achieve even greater efficiencies.

The Challenge



ICAR-IASRI-Initiatives and Way Forward

- ICAR Data Centre established
- ICAR-ERP (MIS&FMS) implemented
- Unified Messaging & Web Hosting solutions initiated

Advancement/Standardizing of Statistical

- Designs both in terms of cost and precision for agricultural systems research
- Methodology for estimation of important agricultural parameters and GIS/Remote Sensing applications
- Forecasting and forewarning models
- Estimation of genetic parameters
- Web resources and repository on advances in statistical techniques with emphasis on design of experiments and sample surveys

- Capacity building through National and International training programmes
- Post Graduate degree courses in agricultural statistics and informatics

- Supporting agricultural biotechnological research by providing computational platform-ASHOKA (Advanced Supercomputing Hub for OMICS Knowledge in Agriculture)
- Supporting Statistical computing through service oriented and customized computing modules

Promoting agricultural informatics through research & application

- Expert/Decision Support/ Knowledge Management Systems
- Mobile Applications