



Executive Summary

Indian Agricultural Statistics Research Institute (IASRI) since its inception is mainly responsible for conducting research in Agricultural Statistics to bridge the gaps in the existing knowledge. The Institute has used the power of Statistics, as a science, blended judiciously with Informatics and has contributed significantly in improving the quality of Agricultural Research. The Institute has also been providing education/training in Agricultural Statistics and Informatics to develop trained manpower in the country. The research and education is used in improving the quality and meeting the challenges of agricultural research in newer emerging areas.

To achieve its goal and mandate, a number of research projects were undertaken during the year. Research was carried out under 72 research projects in the Institute, of which 01 National Professor Scheme, 35 Institute funded, 16 funded by other outside agencies and 20 in collaboration with other Institutes in various thrust areas. This year 18 projects were completed and 34 new projects were initiated.

The Institute has successfully implemented its flagship programme on Strengthening Statistical Computing for NARS, which have paved the way for statistical thinking and publishing research papers in the high impact factor journals.

- For capacity building of the researchers in the usage of high end statistical computing facility, 776 researchers of NARS (496 from ICAR Institutes and 396 from SAUs) have been trained through 37

training programmes of one week duration each. With this the number of researchers trained has gone upto 1672 through a total of 80 training programmes.

- New updates and upgrades have been received and upto March 31, 2012, the software is installed on 1623 computers across NARS out of which 653 installations have been done during the year.
- Strengthened Indian NARS Statistical Computing portal (<http://stat.iasri.res.in/sscnarsportal>) for providing service oriented computing to Indian NARS Users through IP Authentication. Analysis of data generated from any block design (complete or incomplete), augmented block designs, split plot design and combined analysis of block designs is available on this portal.
- For customized analysis, macros for analysis of data generated from Split-split plot designs; Split Factorial (Main A, Sub B x C) designs and econometric analysis have been developed and made available on the project website.

Some other salient research achievements are

- Portal for submission of genomic data and four different genomic databases have been developed and opened for beta testing. This portal would be used for storage of nucleotide, genes, genome, EST, GSS, SNP, RNA etc. apart from number of other biological databases. Functional annotation of ESTs, detection of SSRs, pSNPs, protein

domains, signal peptides have been performed on Water Buffalo using 1825 EST sequences obtained from public domain.

- A block design with neighbour effect(s) is said to be neighbour balanced if every treatment has every other treatment appearing constant number of times as neighbour(s). Robust neighbour balanced complete block designs against one or more missing observations have also been identified. Obtained balanced treatment-control structurally complete/incomplete row-column designs for the experimental situations requiring to compare a set of new (test) treatments with an already existing (control) treatment. Two series of linear trend free block designs balanced for spatial indirect effect from neighbouring experimental unit have been developed. For two way elimination of heterogeneity settings, neighbour balanced row-column designs have been defined wherein every treatment has every other treatment appearing as neighbour constant number of times in rows and columns.
- Minimum aberration fractional factorial plan is one that ensures estimation of maximum number of lower order interactions for a given resolution plan. Minimum aberration fractional factorial plans have been obtained for two level irregular fractional factorials, 5 and 7 level factorial experiments for number of factors ranging from 4 to 15 and mixed level factorial experiments (some factors at 4 levels and rest of the factors at 2 levels each).
- Efficient designs for 3, 4 and 5 components mixture experiments with one process variable have been obtained. The methodology for obtaining optimum combination of ingredients in mixture experiments with process variables has been developed by using dual optimization technique.
- The analytical procedures for block designs, row-column designs and block designs for 2^k factorial experiments have been developed for the situations in which errors follow the t -family of symmetric distributions.
- A catalogue of balanced incomplete block designs and variance balanced block designs that are robust against the loss of any number of observation(s) in a block on the basis of average variance of all possible pairwise treatment comparisons but not on the basis of individual pairwise treatment contrasts has been prepared.
- A general method for constructing variance balanced alternating treatments designs (ATD), suitable for making comparisons of two or more experimental conditions with each other or baseline in veterinary trials has been developed. Designs for making comparisons of investigational products with more than one active control have been obtained.
- Fertilizer response ratios have been computed using data from On Farm trials conducted by Project Directorate of Farming Systems Research, Modipuram. The fertilizer response ratios (FRR) of recommended doses of N, NP, NK and NPK over control for cereals are 9.51 kg/kg, 10.45 kg/kg, 10.00 kg/kg and 11.06 kg/kg respectively. Whereas FRRs for pulses these are 7.77 kg/kg, 6.21 kg/kg, 8.54 kg/kg and 6.37 kg/kg.
- Weather based forewarning models have been developed in two stages, modeling natural growth pattern and relating the deviations (from natural pattern) to appropriate lagged weather variables (maximum relative humidity, minimum relative humidity, maximum temperature, minimum temperature, wind velocity and rainfall with different lags and disease incidence of previous week) for weekly disease incidence. The results indicate that forecasts are quite close to the observed ones except in the first week i.e. week of disease appearance, due to the reason that in this year, disease appeared late as compared to years used for modeling. Time of first appearance can be obtained using the model reported last year and so reliable forecasts for per cent disease incidence can be obtained using two weeks data upto preceding week.
- A small area estimator for small area means has been developed for the situation when population level auxiliary information is not available. The developed small area estimator uses estimated population level auxiliary information using survey weights. Unbiasedness property of the proposed small area estimator has also been studied. Mean square error estimator of small area estimator has also been developed.
- In many agricultural and environmental data, the rate of change of target variable and auxiliary information changes from location to location causing spatial non-stationarity. To incorporate the

spatial non-stationarity in the data, a geographically weighted pseudo empirical best linear unbiased predictor (GWEBLUP) for small area means under area level model has been developed using geographical weighted regression approach. The micro level estimates generated by using the developed small area estimation method are found to have smaller bias and root mean square error as compared to empirical based linear unbiased predictor.

- Estimates of district level poverty incidence have been made using small area estimation technique from NSSO Data. The poverty estimates are found to be highest for MP state followed by UP while the minimum values are obtained for Punjab.
- Optimum sample sizes have been determined for estimation for crop yield estimation at the Gram Panchayat level.
- Structural analyses of proteins belong to detoxifying family for salt stress and proteins from rest of the families have been analysed. All the structures are superimposed and conserved residues are identified. Domain analysis has also been carried out.
- In time series data, certain exceptional external events called 'interventions' could affect the time series phenomenon under study. For forecasting cotton yields, Autoregressive Integrated Moving Average (ARIMA) intervention model is found to be superior to the conventional ARIMA models.
- To deal with asymmetry in time series data, nonlinear time-series models have been used by taking the autoregressive coefficient as a time-varying coefficient and illustrated for building the model considering quarterly oil sardine fish catch in Kerala for the period 1985-2008. The 2009-2010 data has been used for validation.
- Nonlinear time delay neural network (TDNN) models have been found to be outperformed ARIMA models for six and twelve months ahead forecasting in terms of root mean square error and one step ahead forecasting using data on monthly wholesale price of oilseed crops traded in different markets in India.
- For describing cyclical data Self-Exciting Threshold Autoregressive Moving Average (SETARMA) model has been fitted and illustrated using annual

mackerel catch data of Karnataka, India during the period 1961-2008. It is observed that, for hold-out data, observed values are quite close to forecast values and estimated variances are near to theoretical values up to three-steps ahead prediction.

- Bio-physical index based on long term weather parameters and soil conditions etc. has been developed for all 500 districts of the country for assessment of agricultural potential in collaboration with CRIDA. To assess the yield risk at district level Weather Index based models have been developed. Further, classification and regression technique (CART) has been applied on different weather parameters in Tamil Nadu to get various thresholds for yields in rice crop.
- The expenditure elasticities of demand have been estimated for major spices (turmeric, garlic, ginger, dry chilli and other spices) for rural and urban areas of different regions and are found to be moderately inelastic with values 0.65 to 1.0 in all the regions. These elasticities are lower in urban areas as compared to rural areas.
- Study on asymmetry in retail wholesale price transmission for selected essential commodities is conducted for vertical and horizontal cointegration between wholesale and retail price of gram in the selected markets of Bhopal, Chittoor, Delhi and Ganganagar. It indicated that there exists cointegrating vectors and cointegrating equations thereby confirming a long run relationship in the Gram markets. The value of error correction coefficient and the value of long run multiplier are observed.
- Prototype of comprehensive information and online decision support system for effective knowledge delivery for farm entrepreneur related to risk assessment and insurance product have been developed to provide to farmers, insurance companies and policy-makers for risk mitigation against uncertain risks like climate risk, production risks, etc.
- For Half-Yearly Progress Monitoring (HYPM) of the scientists in ICAR, a web based software for online submission of half yearly progress report of the scientists has been designed and developed. This software is implemented from 01 April 2012.

- PIMS-ICAR has been integrated with Half Yearly Progress Monitoring of scientists (HYPM) system developed and implemented for all the ICAR institutes. At present the ICAR institutes have initiated project data entry process for more than 5110 ongoing and 5150 completed projects into PIMS-ICAR from their respective institutes.
- Web based software for survey data analysis (SSDA) 2.0 has been developed and made available on <http://nabg.iasri.res.in/ssda2web/>.
- The operational architecture of National Information System on Agricultural Education Network in India (NISAGENET) has been modified to three tier web architecture and now it is possible to directly enter/update data from university/college(s). 19 Agricultural Universities (AUs) established in the recent past have been added to the system.
- A web based software Statistical Package for Agricultural Research (SPAR) 3.0 has been developed using Microsoft.NET (ASP.NET with C#) technology.

Scientists of the Institute published 90 research papers in National and International refereed Journals along with 20 popular articles, 11 book chapters and 38 projects/technical reports/reference manuals/leaflets. Three macros available at institute's website are also developed.

This year 21 training programmes were organized in which 437 participants were imparted training

- Three International training programmes (two on Application of Remote Sensing and GIS in Agricultural Surveys for the participants from Afro-Asian Rural Development Organization (AARDO) member countries and one on Forecasting Techniques in Agriculture for the participants from Sri Lanka).
- One 21 days and one 10 days training programme under Centre of Advanced Faculty Training on Statistical Modeling in Agriculture.
- Two Winter Schools on Data Mining Techniques and Tools for Knowledge Discovery in Agricultural Database and Recent Advances in Designing and Analysis of Agricultural Experiments.
- Three Resource Generation training programmes on Statistical Techniques for Data Collection and Analysis for Department of Agriculture, Government of Andhra Pradesh and two CSO Sponsored

training programmes on Data Analysis and Interpretation: Use of Statistical Softwares for ISS Probationers and on Agricultural Statistics for CSO officials.

- Nine training programmes were conducted under National Agricultural Innovation Projects:
 - Seven under Consortium on Strengthening Statistical Computing for NARS, (i) A Researcher Training on Data Analysis using SAS, (ii) Some Specific Examples on Data Analysis of Natural Resources Management Research, (iii) Genetics/Genomics Data Analysis using SAS, (iv) Data Analysis in Social Sciences Research using SAS, (v) Data Analysis and Interpretation in Farm Implementation and Machinery Research using SAS, (vi) Data Mining using SAS and (vii) Data Analysis using SAS.
 - One training programme on Forecast Modelling in Crops sponsored by NAIP.
 - One on Recent Advances in Statistical and Computational Genomics Data Analysis under NAIP Consortium on Bio-prospecting of Genes and Allele Mining for Abiotic Stress Tolerance.
- Two training programmes through outsourcing on Computational Genome Analysis using ANYAYA and on High Performance Bio-Computing and Drug Design under National Agricultural Bioinformatics Grid were also organized.

Dr. VK Bhatia was conferred upon the prestigious title of Sankhyiki Bhushan by Indian Society of Agricultural Statistics. He was nominated as Statistical Coordinator for DARE and as Member of Steering Group for Agricultural Statistics by Economic and Social Commission for Asia and the Pacific (ESCAP) of United Nations.

Dr. Rajender Parsad was awarded National Award in Statistics for Young Statistician in honour of Prof. CR Rao 2010-11 from Ministry of Statistics and Programme Implementation, Government of India.

Dr. Prajneshu received Prof. PV Sukhatme Gold Medal Award 2011 from ISAS and elected as Fellow of NAAS.

Dr. Yogita Gharde received Dr. GR Seth Memorial Young Scientist Award from ISAS.

Dr. Ranjana Agrawal received Scroll of Appreciation at XX Group Worker's Meeting of AICRP on STF.



Dr. Eldho Varghese received IARI Merit Medal for outstanding research work as a part of Ph.D. (Agricultural Statistics) from PG School, Indian Agricultural Research Institute.

Dr. Sudeep and Dr. Alka Arora received Achievement Award in special recognition of research to the field and also in special appreciation of valuable services to the Conference in the 5th Indian International Conference on Artificial Intelligence.

Dr. Anil Kumar received Young Professional Award 2011 of the Society for Community Mobilization for Sustainable Development.

Dr. VK Bhatia was deputed to attend ISO/TC/69 Technical Committee/Sub Committee and Working Groups at Berlin, Germany and to attend the First meeting of the Steering Group for Agricultural Statistics at Manila, Philippines.

Dr. UC Sud was deputed to attend 4th Meeting of WYE Group of Statistics on Rural Development and Agriculture Household Income at Brazil.

Dr. Anil Rai was deputed to FAO, Sri Lanka to provide Consultancy Services on Feasibility Study on the use of GIS/Remote Sensing for Census of Agriculture by Food and Agricultural Organisation.

Dr. Hukum Chandra completed Post Doctoral Research of one year at the Centre for Statistical and Survey Methodology in the University of Wollongong, Australia and participated in International Statistical Institute (ISI) World Statistics Congress held at Dublin, Ireland sponsored by International Statistical Institute's World Bank Fund Award.

Dr. Sushila Kaul was deputed to attend 4th International Conference on Inclusive Museum at University of Witwatersrand, Johannesburg, South Africa.

Dr. Ramasubramanian V. was deputed to attend International training programme in the area of Science

Policy and Technology Forecasting at University of Houston, USA under NAIP-HRD-L&CD, Social Sciences Division.

Two Partners Meet of NAIP Consortium on Strengthening Statistical Computing for NARS and one for National Agricultural Bioinformatics Grid (NABG) were organised.

Second Workshop-cum-Installation training programme for Nodal Officers of NAIP Consortium on Strengthening Statistical Computing for NARS was organized.

Workshop related to the project Evaluation of Agricultural Census Scheme was organised.

Institute celebrated Birth Centenary of Professor PV Sukhatme on 27 July 2011.

Three sensitization-cum-training workshops on NISAGENET for the Nodal Officers of SAUs were organised at UP, Mumbai and Tirupati and five on HYPM for the Nodal Officers at IASRI, New Delhi; CIFE, Mumbai; DWM, Bhubaneshwar and NAARM, Hyderabad were organized.

The activities relating to education and training which include planning, organization and coordination of the entire Post-graduate teaching programmes of the Institute were undertaken in collaboration with PG School, IARI. During the year, a total of 17 students {03 Ph.D. (Agricultural Statistics), 07 M.Sc. (Agricultural Statistics) and 07 M.Sc. (Computer Application)} completed their degrees. 21 new students {06 Ph.D. (Agricultural Statistics), 08 M.Sc. (Agricultural Statistics), 04 M.Sc. (Computer Application) and 03 M.Sc. (Bioinformatics)} were admitted.

A Senior Certificate Course in Agricultural Statistics and Computing was organised. 05 officials participated in this Certificate Course.



ORGANOGRAM

RESEARCH ADVISORY COMMITTEE ↔ DIRECTOR ↔ INSTITUTE MANAGEMENT COMMITTEE

