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Executive Summary

Indian Agricultural Statistics Research Institute (IASRI) established in 1959 as an Institute of Agricultural Research Statistics is mainly responsible for conducting research and education/training in Agricultural Statistics. With the advances in information technology, the Institute has adapted itself to the current needs of agricultural research. In the changed scenario, the mandate of the Institute is to undertake basic, applied and adaptive research in Agricultural Statistics, to conduct post graduate and in-service training courses in Agricultural Statistics and Computer Applications, to provide consultancy services, to act as a repository of information on Agricultural Statistics for research, to develop the Institute as an Advanced Centre of Excellence in education and training in Agricultural Statistics and Computer Applications and to liaise with other ICAR Institutes and SAUs, State Agricultural/ Animal Husbandry Departments, to assist in the development and strengthening of National Agricultural Statistics System and to undertake sponsored research and training of national and international organizations in these disciplines.

A number of research projects were undertaken during the year in different Divisions of the Institute namely Design of Experiments, Biometrics and Statistical Modeling, Forecasting and Econometrics Techniques, Sample Surveys, Computer Applications and Centre for Agricultural Bio-informatics [CABin]. Research was carried out under 46 research projects in the Institute, of which 01 National Professor Scheme, 22 Institute funded, 12 funded by other outside agencies and 11 in collaboration with other Institutes in various thrust areas. This year 11 projects were completed and 12 new projects were initiated.

The Institute has taken two major initiatives under NAIP, Strengthening Statistical Computing for NARS and Establishment of National Agricultural Bioinformatics Grid.

NAIP Consortium on Strengthening Statistical Computing for NARS (www.iasri.res.in/sscnars) has been initiated that targets

- At providing research guidance in statistical computing and computational statistics and creating sound and healthy statistical computing environment.
- To provide enabling statistical computing facilities to the researchers of NARS, a general purpose statistical software package has been procured with 151 licenses including one SAS Enterprise Business Intelligence Server for perpetual use with three years updates and upgrades.
- For capacity building of the researchers in the usage of high end statistical computing facility, 209 trainers have been trained through 30 working days training programmes on SAS: A Comprehensive Overview, 5 days programme on SAS Genetics/ JMP Genomics and 6 days training programme on Data Analysis Using SAS across 83 NARS organizations. 892 researchers of NARS (496 from ICAR Institutes and 396 from SAUs) have been trained through 43 training programmes of one

week duration each. This capacity building effort in the usage of high end statistical computing and statistical techniques has paved the way for publishing their research in high impact factor journals.

- For providing a service oriented computing to Indian NARS users, a Portal has been established which is available to NARS users through IP Authentication at http://stat.iasri.res.in:8080/sscnarsportal. Any researcher from Indian NARS may obtain User name and Password from Nodal Officers of their respective NARS organizations. Analysis of data generated from any block design (complete or incomplete) and split plot design is available on this portal.

In order to keep pace with the research and developments in agricultural bioinformatics at global level, another initiative has been taken for establishing National Agricultural Bioinformatics Grid (NABG) which in turn would help in developing databases, data warehouse, software and tools, algorithms, genome browsers and high-end computational facilities through systematic and integrated approach in the field of agricultural bioinformatics. Supercomputing facilities involving five different domain organizations, namely NBPGR, New Delhi; NBAGR, Karnal; NBFGR, Lucknow; NBAIM, Mau and NBAII, Bengaluru will be developed. This will be national facility which will provide computational framework to support biotechnological research in the country. NABG is also aimed for capacity building for research and development in agricultural bioinformatics.

Some other salient research achievements are:

- Generalized incomplete Trojan-type designs have been obtained for experiments where it is required to control two cross classified sources of variability in the experimental units and the number of treatments may be substantially larger than the number of replicates. A catalogue consisting of number of treatments (v) ≤ 30, number of rows (m), number of columns (n), cell size (k) and number of replications (r) has been prepared.
- Bioequivalence trials are conducted for evaluation of veterinary medical products. Efficient variance balanced designs for bioequivalence trials have been obtained and catalogued.
- Experiments with biological entities often involve application of a sequence of treatments to each experimental unit over varying periods of time and are conducted using crossover designs. An algorithm for obtaining efficient circular balanced or circular strongly balanced crossover designs using linear programming approach has been developed.
- Design Resources Server has been strengthened by adding new link on orthogonal arrays. The catalogues of block designs with factorial treatment structure in 3-replications for number of levels for any factor at most 12 and that of χ^2-optimal multi-level supersaturated designs (SSDs) and k-circulant multi-level SSDs have also been updated.
- Weighted A-optimal block designs for multiple parallel line assays have been obtained.
- Fertilizer Response Ratios (FRR) for rice-wheat crop sequence at NARP zone, State and National level have been obtained from the data of the experiment “Response of Nutrients” conducted at various regions of country at farmer’s field during 1999-2000 to 2008-09. Eight fertilizer response ratios for different fertilizer combinations such as N, NP, NK, NPK over control, P over N and NK, K over N and NP have been worked out using data of 1406 trials across 6 states. FRR of NPK over control of rice crop varies from 6.96 kg/kg (Maharashtra) to 19.41 kg/kg (Bihar). In most of the states, FRR of NPK over control of rice crop is more than 12kg/kg except Maharashtra, Uttarakhand and Jharkhand. The fertilizer response ratios of wheat in rice-wheat crop sequence is at lower level than rice in almost all states.
- Developed sampling methodology for estimation of meat production in Meghalaya.
- Forewarning models for time of first appearance of powdery mildew on second flush have been developed using weather starting from 49th standard meteorological week (smw) i.e. first week of December. Maximum relative humidity, maximum temperature, wind speed and their interactions are found important in different models. Using these models earliest forecast can be obtained at 50th smw which can be subsequently revised.
- In the class of nonlinear time-series models, Exponential Autoregressive (EXPAR) models may be employed to describe those data sets that depict periodic fluctuations. Formulae for carrying out more than one-step ahead forecasts are developed

analytically using the concept of 'conditional expectations'. EXPAR model is illustrated for modelling and forecasting of Oil Sardine catches in Kerala.

- Linear combination weighted scoring, multi-dimensional scaling and analytical hierarchical process methods have been used for envisioning technologies/ prioritizing factors in rainfed agriculture from around 50 filled-in questionnaires from subject matter experts. The results revealed that stability of crops should be given highest research priority followed by early maturity, broad adoption, stress resistance and high yield potential in achieving high productivity in rainfed areas.
- Distance balanced sampling plans have the property that the second order inclusion probabilities are non-decreasing function of distance between two contiguous units and are useful for sampling from populations in which nearer units provide similar observations due to natural ordering of units in time or space. Several families of distance balance sampling plans have been obtained using linear integer programming.
- Study on future trading in mentha oil concludes that the two price series i.e. future and spot, becomes stationary at first difference. Persistent volatility is much severe in the financially disturbed years 2008 and 2009 as compared to the previous years. Spot price series showed higher level of persistent volatility as compared to future price series.
- Developed an algorithm to determine and identify optimum number and combination of molecular markers required for explaining the maximum diversity present in the data. Genomic sequence information on abiotic stress related genes of different traits, *viz.*, moisture stress, submergence, salinity, cold and heat for crop, animal, fish and microbe species has been collected and a library is created. Phylogenetic analysis of the genes responsible for abiotic stress tolerance traits across species has been studied and compared for conserved regions through structural visualization. A database on core collection of germplasm for rice has been designed and online entry forms are developed.
- The study of structure and determinants of groundwater markets, costs and returns for important crops under different water markets indicated that groundwater markets are actively functioning in electric tubewell command areas in Upper, Middle and Lower-Gangetic plains.
- PERMIS*net*-II system has been enriched with new modules such as passport information, username and password for individual, updating rights to individuals, strengthening of manpower planning reports and monitoring reports. The passport information can, however, be updated by individual users after getting username and password from their respective nodal officers.
- Online mangement system for PG Education implemented in PG School, IARI from the academic year 2009-10, has been strengthened with Pending Work Status that appears on the home page of the user and auto generated e-mail facility. At present the system has 522 registered students and 503 faculty members. The system has 1126 courses listed in 23 disciplines.
- Developed AgriDaksh, a tool for building online expert system, that has modules on Knowledge Model Creation, Knowledge Acquisition, Problem Identification, Knowledge Retrieval, Ask Questions to Experts and Administration. AgriDaksh enables domain experts to build online expert system in their crops with minimal intervention of knowledge engineers and programmers. Maize AgriDaksh is the first system developed in collaboration with Directorate of Maize Research, New Delhi using AgriDaksh. Maize AgriDaksh provides ICT based advisories on Maize Crop and allows interaction with experts using Internet. Maize AgriDaksh is available online at http://expert.iasri.res.in/agridaksh.
- Developed Expert System on Seed Spices (EXPSS) for crop management of 4 major and 6 minor seed spices in collaboration with NRC Seed Spices, Ajmer. It provides expert advice on variety selection, field preparation, fertilizer application, schedule of irrigation, plant protection from pests/ diseases/nematodes. EXPSS is available at http://iasri.res.in/expss.
- Project Information and Management System of ICAR hosted at http://pimsicar.iasri.res.in/ has been developed as a web enabled system to help in taking decisions to check duplication in research projects both at divisional as well as inter divisional level of ICAR. Auto extracted keyword based search approach has been used for the development of the Duplicate Detection Module capable to assist

in identification of duplication of research activities at divisional and inter divisional level of ICAR.

- To fulfill the increasing demand of online interactive PG courses, an eLearning platform "eLearnAgriculture" has been designed and developed and implemented for the post graduate courses in Agriculture Sciences and is available at http://www.elearnagri.iasri.res.in/home. The system provides an opportunity to the agricultural educationists to create and link their course contents online.
- A web based software for cataloguing, generation and analysis of PBIB designs has been developed using client server architecture.

Scientists of the Institute published 49 research papers in National and International refereed Journals along with 09 popular articles, 02 book chapters and 25 projects/technical reports/reference manuals.

Dr. VK Gupta was conferred upon the prestigious title of Sankhyiki Bhushan by Indian Society of Agricultural Statistics. Dr. VK Bhatia and Dr. Rajender Parsad have been elected as Fellow of National Academy of Agricultural Sciences from 01 January 2011.

Dr. Rajender Parsad received Prof. PV Sukhatme Gold Medal Award for the year 2009-10 from Indian Society of Agricultural Statistics.

डॉ. रंजना अग्रवाल को वैज्ञानिक लेख 'मौसम चरों पर आधारित फ़सलों का पूर्वानुमान' के लिये केन्द्रीय सचिवालय हिन्दी परिषद् द्वारा अखिल भारतीय महिला विशेष पुरस्कार (2008-09) से पुरस्कृत किया गया ।

Dr. Anil Kumar received Young Scientist Award 2010 by the Hi-Tech Horticultural Society.

Research paper entitled Market efficiency in commodity futures - A case study by Bhardwaj, SP and Vasisht, AK received Best Paper Award of Rs. 5000/- at International Conference on Financial Derivatives held at Pondicherry University, Pondicherry.

Dr. VK Bhatia, Dr. Lalmohan Bhar, Dr. Hukum Chandra, Dr. Himadri Ghosh, Dr. Prajneshu and Dr. Ramasubramanian, received Best Paper Awards from the Indian Society of Agricultural Statistics for the papers published in Journal of Indian Society of Agricultural Statistics during 2009-10.

Dr. VK Bhatia and Dr. UC Sud were deputed to attend the V International Conference on Agricultural Statistics held at Kampala, Uganda. Dr. Sushila Kaul and Smt. Sangeeta Ahuja were deputed to present their papers in Turkey and Germany, respectively. Dr. Prajneshu visited University of North Carolina at Greensboro, USA as Visiting Scholar.

Five scientists of the Institute have undergone foreign training programme on Technology Forecasting, Crop Science Bioinformatics, Multimarket Modelling for Policy Analysis and Principles and Applications of Remote Sensing and GIS.

This year twenty seven training programmes were organized in which 553 participants were imparted training

- Three International training programme on (i) Agricultural Statistics System in India for the Officials of SAARC countries, (ii) Early Warning System for Food Security for the participants from Yemen and (iii) Application of Remote Sensing and GIS in Agricultural Surveys for the participants from Afro-Asian Rural Development Organization (AARDO) member countries.
- A twenty one days training programme under Centre of Advanced Faculty Training on Statistical Modeling in Agriculture.
- Winter School on Development of Expert Systems in Agriculture.
- CSO Sponsored 24 days training programme on Data Analysis with Statistical Packages for Indian Statistical Service (ISS) Probationers of XXX batch.
- A refresher training programme on Small Area Estimation for In-service ISS officers and senior officers of State Governments/Union Territories.
- Sixteen training programmes were conducted under various Research Projects
  - Twelve training programmes under NAIP Consortium on Strengthening Statistical Computing for NARS (i) SAS Platform Administration training for SAS EBI Server (ii) SAS Installation training (iii) SAS: A Comprehensive Overview (iv) SAS Genetics/ JMP Genomics (v) Data Analysis of Agroforstry Experiments using SAS (vi) Seven training programmes for researchers' on Data , Analysis Using SAS

- One training programme on Statistical and Computational Genomics Data Analysis under NAIP Consortium on Bio-prospecting of Genes and Allele Mining for Abiotic Stress Tolerance
- One training programme on Technological Forecasting Methodologies under NAIP Consortium on V-PAGe
- Two training programmes on Bioinformatics Resources and Tools for Agricultural Research under National Agricultural Bioinformatics Grid
- One training programme on Research Methodology for Socio-Economic Studies at National Council of Applied Economic Research Centre for Macro Consumer Research
- Three other training programmes, one part time two days special computer training programme and two full time two days special computer training programme for the officials of ICAR Hqrs

A travel workshop on Resolvable Designs and Design Resources Server was organised and attended by 50 participants at CCSHAU, Hisar.

XVI National Conference of Agricultural Research Statisticians was organised.

Two launch workshops of (i) NAIP Consortium on Strengthening Statistical Computing for NARS and (ii) National Agricultural Bioinformatics Grid (NABG) were organised.

Institute celebrated the first World Statistics Day on 20 October 2010 and organized a symposium on Statistics in Agricultural Development.

Four sensitization cum training workshops on PIMS-ICAR for the Nodal Officers of ICAR Institute were organised at IASRI, New Delhi; NAARM, Hyderabad; DWM, Bhubneshwar and CIAE, Bhopal.

Three sensitization cum training workshops on NISAGENET for the Nodal Officers of SAU's were organised at IASRI, New Delhi and AAU, Anand.

Five Interactive meets on (i) Role of IASRI in Improving R&D Efficacy of NARS (ii) Enhancing the Role of IASRI in R&D Efficacy of ICAR Institutions of NRM Division (iii) Role of IASRI in Enhancing R&D Efficacy of NARS with Animal Science Division of ICAR (iv) Integration of IT Efforts in the ICAR (v) Information and Communication Technology in ICAR were organised.

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 10 students, {06 M.Sc. (Agricultural Statistics) and 04 M.Sc. (Computer Application)} completed their degrees. 20 new students {05 Ph.D. (Agricultural Statistics), 09 M.Sc. (Agricultural Statistics) and 06 M.Sc. (Computer Application)} were admitted.

A Senior Certificate Course in Agricultural Statistics and Computing was organised. 22 officials from India and Sri Lanka participated in this Certificate Course.

To promote Hindi, a poster presentation was organized at the Institute and awards were distributed for the outstanding performances.


माननीय डा एस. अय्यमपेरुमल
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