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Introduction

Indian Agricultural Statistics Research Institute (IASRI) is a premier Institute of Indian Council of Agricultural Research (ICAR) with glorious tradition of carrying out research, teaching and training in the area of Agricultural Statistics and Informatics. Ever since its inception way back in 1930, as small Statistical Section of the then Imperial Council of Agricultural Research, the Institute has grown in stature and made its presence felt both nationally and internationally. IASRI has been mainly responsible for conducting research in Agricultural Statistics and Informatics to bridge the gaps in the existing knowledge. It has also been providing education/ training in Agricultural Statistics and Informatics to develop trained manpower in the country. The research and education is used in improving the quality and meeting the challenges of agricultural research in newer emerging areas.

The functions and activities of the Institute have been re-defined from time to time in the past. The present main thrust of the Institute is to undertake research, education and training in the discipline of Agricultural Statistics, Computer Applications and Bioinformatics and to develop trained manpower to address emerging challenges in agricultural research.

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

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

The Institute has made its presence felt in the National Agricultural Research System (NARS). The Institute is also becoming progressively a repository of information on agricultural research data and has taken a lead in the country in developing a data warehouse on agricultural research data. IASRI is implementing the robust and flexible MIS & FMS System which includes solution for Financial Management, Project Management, Material Management, Human Resource Management and Payroll at ICAR. The Institute has

established linkages with all NARS organizations for strengthening statistical computing. A National Agricultural Bioinformatics Grid is being developed with high performance computing facilities. The Institute also occupies a place of pride in the National Agricultural Statistics System (NASS) and has made several important contributions in strengthening NASS, which has a direct impact on the national policies. Some of the research activities and their impact are given in the sequel:

Significant Research Achievements and Impact

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

Design of Experiments

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

- Designs for single factor experiments which include variance balanced, efficiency balanced, and partially efficiency balanced designs; designs for tests versus control(s) comparisons; designs for multi-response experiments; crossover designs; designs with nested structures; neighbour balanced designs; optimality and robustness aspects of designs;

- Designs for multi-factor experiments which include confounded designs for symmetrical and asymmetrical factorials; block designs with factorial structure; response surface designs, mixture experiments for single and multifactor experiments; Orthogonal main effect plans; orthogonal arrays; Supersaturated designs;

- Designs for bioassays; designs for microarray experiments; designs for agroforestry experiments;

- Diagnostics in designed field experiments;

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

- The creation of Design Resources Server, an e-learning and e-advisory resource for the experimenters, has been another revolution in the growth of the Institute. The server provides a platform to popularize and disseminate research and also to further strengthen research in newer emerging areas in design of experiments among peers over the globe

in general and among the agricultural scientists in particular so as to meet the emerging challenges of agricultural research. This server is hosted at www.iasri.res.in/design.

The scientists of the Institute participate actively in planning and designing of experiments in the NARS and have also involved themselves in the analysis of experimental data.

- Basic research work carried out on balanced incomplete block designs, partially balanced incomplete block designs, group divisible designs, α-designs, reinforced α-designs, square and rectangular designs, nested designs, augmented designs, extended group divisible designs, response surface designs, experiments with mixtures etc. have been adopted widely by the experimenters in NARS.

- Designs for factorial experiments such as response surface designs and experiments with mixtures have been used for food processing and value addition experiments; soil test crop response correlation experiments; experiments with fixed quantity of inputs and ready to serve fruit beverage experiments, etc.

- Analytical techniques based on mixed effects models and biplot developed for the analysis of data generated from Farmers Participatory Trials for resource conservation agriculture have been used by rice-wheat consortium for Indo-Gangetic plains for drawing statistically valid conclusions.

- Analytical techniques for the analysis of data from the experiments conducted to study the post harvest storage behaviour of the perishable commodities like fruits and vegetables are being widely used in NARS.

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

Sample Surveys

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

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

- The methodology for General Crop Estimation Surveys (GCES), cost of cultivation studies for principal food crops, cash crops and horticultural crops, Integrated Sample Surveys (ISS) for livestock products estimation, fruits and vegetable survey are being adopted throughout the country.

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

- Sample survey methodologies for imported fertilizer quality assessment, estimation of fish catch from marine and inland resources, flower production estimation, area and production of horticultural crops estimation, etc. have been developed and passed on to the user agencies.

- Integrated methodology for estimation of multiple crop area of different crops in North Eastern Hilly Regions using Remote Sensing data has been developed.

- Sampling methodology for estimation of post harvest losses has been successfully adopted in AICRP on Post Harvest Technology for assessment of post harvest losses of crops/commodities.

- Reappraisal of sampling methodologies, evaluation and impact assessment studies like Assessment of Integrated Area Development programmes, High Yielding Varieties programmes, Dairy Improvement programmes, Evaluation of cotton production estimation methodology etc. have been undertaken. Most of the methodologies developed are being adopted for estimation of respective commodities by the concerned state Departments.

- The Institute is regularly publishing the Agricultural Research Data Book since 1996. It contains information pertaining to agricultural research, education and other related aspects compiled from different sources.

Statistical Genetics and Genomics

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

- Modification in the procedure of estimation of genetic parameters has been suggested for incorporating the effect of unbalancedness, presence of outliers, aberrant observations and non-normality of data sets.

- Procedures for studying genotype environment and QTL environments interactions have been developed and used for the analysis of data generated from crop improvement programmes.

- Research work on construction of selection indices, progeny testing and sire evaluation have been used for animal improvement programmes.

- The Institute has initiated research in the newer emerging area of statistical genomics such as rice genome functional elements information system; comparative genomics and whole genome association analysis. The establishment of a National Agricultural Bioinformatics Grid (NABG) is a landmark in this direction.

- A number of databases and web services have been developed which include pigeonpea microsatellite database, buffalo microsatellite database, genome sequence submission portal, livestock EST database, insect barcode database.

Statistical Modelling

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

- The Institute has made significant contributions in developing models for pre-harvest forecasting of crop yields using data on weather parameters; agricultural inputs; plant characters and farmers' appraisal.

- Models have been developed using weather and growth indices based regression models, discriminant function approach, markov chain approach, bayesian approach, within year growth models and artificial neural network approach.

- Methodologies for forewarning important pests and diseases of different crops have been developed which can enable the farmers to use plant protection measures judiciously and save cost on unnecessary sprays.

- The methodology developed for forecasting based on weather variables and agricultural inputs was used by Space Application Centre, Ahmedabad, to obtain the forecast of wheat yield at national level with only 3% deviation from the observed one.

- Models developed for forewarning of aphids in mustard crop were used by Directorate of Rapeseed and Mustard Research, Bharatpur to provide forewarning to farmers which enabled them to optimize plant protection measures and save resources on unnecessary sprays consecutively for three years.

- Forecasting of volatile data has been attempted through non-linear time series models. Such models were developed for forecasting onion price, marine products export, lac export, etc.

- Non-linear statistical models were developed for aphid population growth and plant diseases. Modelling and forecasting of India's marine fish production was carried out using wavelet methodology. The models developed have potential applications in long term projections of food grain production, aphid population, marine fish production, etc.

Econometrics

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

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

Information Communication Technology

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

- The Institute has developed information systems for agricultural field experiments, animal experiments and long term fertilizer experiments conducted in NARS as research data repositories.

- A comprehensive Personnel Management Information System Network (PERMISnet) has been implemented for the ICAR for manpower planning, administrative decision making, and monitoring. A Project Information and Management System Network (PIMSnet) was developed and implemented for concurrent monitoring and evaluation of projects. This is being developed as a Project Information and Management System for all ICAR projects. A National Information System on Agricultural Education Network in India (NISAGENET) has been designed, developed and implemented so as to maintain and update the data regularly on parameters related to agricultural education in India.

- Online Management System for Post Graduate Education has been developed and implemented for PG School, IARI, New Delhi. The Institute has taken a lead in the development of Expert Systems on wheat crop, maize crop and seed spices. AgriDaksh has been developed for facilitating the development of expert systems for other crops.

- Realizing the need of integration of databases to prepare a comprehensive knowledge warehouse that can provide desired information in time to the planners, decision makers and developmental agencies, Integrated National Agricultural Resources Information System (INARIS) has been developed. The data warehouse comprises of databases on agricultural technologies of different sectors of agriculture and related agricultural statistics at districts/state/national levels, population census including village level population data as well as tehsil level household assets and livestock census. Subject-wise data marts have been designed, multi-

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dimensional data cubes developed and published in the form of on-line decision support system. It is being developed as knowledge data warehouse through the development of Knowledge Management for Agricultural Research and Technologies (KMART). The system also provides facility of spatial analysis of the data through web using functionalities of Geographic Information System (GIS).

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

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

- For providing service oriented computing, the Institute has developed Indian NARS Statistical Computing Portal which is available to NARS users through IP authentication and is being widely used by the researchers. Sample Survey Resources has also been created with a goal to disseminate research in theory, application and computational aspects of sample survey among the statisticians in academia, practicing statisticians involved in advisory and consultancy services, scientists in the National Agricultural Research System, and the statisticians involved in conducting large scale sample surveys, particularly in the National Statistical System with focus on agricultural statistical system.

Human Resource Development

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

- The institute conducts the Senior Certificate Course in Agricultural Statistics and Computing. This course is of six months duration and lays more emphasis on statistical computing using statistical software. The course is divided into two modules viz. (i) Statistical Methods and Official Agricultural Statistics, and (ii) Use of Computers in Agricultural Research, of three months duration each. In all 85 participants have completed both the modules, 38

have completed module-I and 21 have completed module-II since 1997.

- The Institute also conducts degree courses leading to M.Sc. and Ph.D. in Agricultural Statistics and M.Sc. in Computer Application in collaboration with Indian Agricultural Research Institute (IARI), New Delhi. The Institute has so far produced 182 Ph.D. and 314 M.Sc. students in Agricultural Statistics and 105 M.Sc. students in Computer Application. A new degree course M.Sc. in Agricultural Bioinformatics has started from academic year 2011-12 in collaboration with IARI, New Delhi; NRCPB, New Delhi and NBPGR, New Delhi.

- The Institute is functioning as a Centre of Advanced Studies in Agricultural Statistics and Computer Application. Under this programme the Institute organizes training programmes on various topics of interest for the benefit of scientists of NARS. These training programmes cover specialized topics of agricultural sciences. The Centre of Advanced Studies (CAS) is now renamed as Centre of Advanced Faculty Training (CAFT). So far, 51 training programmes have been organised under the aegis of CAS/CAFT and in all a total of 931 participants have been benefitted.

- There is another form of training course, which are tailor made courses and are demand driven. The coverage in these courses is need based and the courses are organized for specific organizations from where the demand is received. The Institute has conducted such programmes for Indian Council of Forestry Research, Indian Statistical Service probationers and senior officers of Central Statistical Organization and many other organizations.

- The Institute has also conducted several international training programmes on request from FAO, particularly for African, Asian and Latin American countries.

- The Institute has broadened the horizon of capacity building by opening its doors to the agro-based private sector. One such training programme was organized for research personnel of E.I. DuPont Pvt. Ltd. The Institute has also conducted training programmes for the scientists/research personnel of CGIAR organizations such as ICARDA and Rice-Wheat Consortium for Indo-Gangetic plains.

Infrastructural Development

As the activities of the Institute started expanding in all directions, the infrastructure facilities also started expanding. Two more buildings 'Computer Centre' and 'Training-cum-Administrative Block' were constructed in the campus of the Institute in the years 1976 and 1991, respectively. There are three well furnished hostels, viz. Panse Hostel-cum- Guest House, Sukhatme Hostel and International Training Hostel to cater to the residential requirements of the trainees and students. An important landmark in the development of the Institute was the installation of an IBM 1620 Model-II Electronic Computer in 1964. A third generation computer Burroughs B 4700 system was installed in March 1977 and then replaced in 1991 by a Super Mini COSMOS-486 LAN Server with more than hundred nodes consisting of PC/AT's, PC/XT's and dumb terminals all in a LAN environment. Later, COSMOS-486 LAN Server was replaced by a PENTIUM-90 LAN Server having state-of-art technology with UNIX operating system. Computer laboratories equipped with PCs, terminals and printers, etc. had been set up in each of the six Scientific Divisions as well as in the Administrative Wing of the Institute.

For undertaking research in the newer emerging areas, a laboratory on Remote Sensing (RS) and Geographic Information System (GIS) was created in the Institute. The laboratory was equipped with latest state-of-art technologies like computer hardware and peripherals, Global Positioning System (GPS), softwares like ERMapper, PCARC/INFO, Microstation 95, Geomedia Professional, ARC/INFO Workstation and ERDAS Imagine with the funds received through two AP Cess Fund projects. This computing facility has further been strengthened with the procurement of ARC-GIS software under NATP programme.

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

The networking services at IASRI have steadily been strengthened. Currently the internet services are being provided to the scientists, technical & administrative staff and students through Firewall, Content filtering, E-mail filtering, Antivirus, Application control and Data Leak Prevention (DPL). The Institute domain service like Primary and Secondary DNS, Domain (iasri.res.in) Website (http://www.iasri.res.in), Live E-mail services, more than 462 network nodes and number of various Online Information Systems are being developed and maintained by the Institute.

There are various labs at the Institute for dedicated services like ARIS lab for training, Statistical computing lab, Stat lab for Statistical analysis, Student lab and Centre for Advanced Study lab. Some of the important available software are SAS 9.2, SAS 9.3, JMP 8.0, JMP 10.0, JMP Genomics 4.0, 5.1, 6.0, SAS BI Server 4.2, SPSS, SYSTAT, GENSTAT, Data warehouse software – Cognos, SPSS clementine, MS Office 2007, MS Visual Studio.net, MS-SQL Server, Oracle, Macro-Media, E-views, STATISTICA Neural Networks, Gauss Software, Minitab 14, Maple 9.5, Matlab, Web Statistica, Lingo Super, ArcGIS among others.

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

multimedia projectors etc. The Institute is also well equipped with 100 MBps bandwidth fiber optics backbone wired and wireless networking campus.

The Library of IASRI is considered as a well known and specialized library in terms of its resources in the form of print and electronic format in the field of agricultural statistics, computer applications, agricultural economics and allied sciences. It is recognized as one of the regional libraries under NARS with best IT agricultural library under ICAR system.

During the XI Plan period, the library has undergone ocean of changes in terms of its resources. It has strengthened the resource base in terms of core foreign journals. With procurement of online and CD-ROM bibliographical data bases the awareness for the use of data bases has increased and users are able to access scientific information in the field of their interest without wasting their time by clicking of a button. All house keeping activities of the library have been computerized and bar-coded and all bonafide library users have been issued electronic membership cards and all Ph.D. and M.Sc. Thesis have been digitized and given access to users through LAN. Library of the Institute got associated with CERA in terms of electronic document delivery services. The library reading room has been renovated with 5 split air conditioners to provide congenial environment for readers. All library users were given training to access on-line services available in the library.

Organisational Set-up

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

Divisions
- Design of Experiments
- Biometrics and Statistical Modelling
- Forecasting and Econometrics Techniques
- Sample Surveys
- Computer Applications
- Centre for Agricultural Bioinformatics [CABin]

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

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

Unit
- Institute Technology Management Unit (ITMU)

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

Financial Statement

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

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

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

Staff Position (as on 31 March 2013)

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

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IASRI NEWS

Volume 17   No. 4   January-March, 2013

From Director's Desk ...

सांख्यिकी-विमर्श

अंक 8

2012-13

भारतीय कृषि सांख्यिकी अनुसंधान संस्थान
(भा.कृ.अनु.प.)
लाइब्रेरी एवेन्यू, पूसा, नई दिल्ली-110012

IASRI NEWS

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RESEARCH ACHIEVEMENTS

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

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IASRI ANNUAL REPORT 2011-12

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कृषि अनुसंधान डाटा पुस्तिका

AGRICULTURAL RESEARCH DATA BOOK 2012

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