Annual Report

2020

ICAR - Indian Agricultural Statistics Research Institute

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https://iasri.icar.gov.in

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Preface

It is a matter of proud privilege, immense pleasure and great satisfaction to present the Annual Report 2020 (January-December) of ICAR-Indian Agricultural Statistics Research Institute (ICAR-IASRI), an ISO 9001:2008 certified Institute with proven track record and science based commitment of carrying out research, teaching and training in the area of Agricultural Statistics (Sample Surveys, Design of Experiments, Statistical Modeling & Forecasting and Statistical Genetics) and Informatics (Computer Applications and Bioinformatics). This report highlights the research achievements that came to fruition in the year 2020, new methodologies developed, consultancy services provided, significant methodological and computational support, dissemination of knowledge acquired and human resource development, particularly post graduate and doctoral level teaching and research guidance. The esteemed scientists, technical personnel, administrative, finance and other staff have rose to the occasion and put in their best efforts in fulfilling the mandate of the Institute.

During the year, 35 in-house projects were carried out, out of which 20 were ongoing, 10 projects got completed and 5 were newly initiated; 50 externally funded projects were carried out, out of which 27 were ongoing, 17 projects got completed and 6 were newly initiated. Apart from these 85 projects, one consultancy project and one ICAR National Fellow Scheme project were also handled at our institute.

Methods of construction for obtaining pairwise and/or variance balanced SIRC (Structurally Incomplete Row-Column)/BILS (Balanced Incomplete Latin Square) designs have been obtained using symmetric BIB designs, union of two variance balanced SIRC/BILS designs or adding treatments in existing variance balanced SIRC designs. In agroforestry experiments, different species of trees may interact spatially and experimental plots may be connected through a network of trees which would create non-directional adjacency effects on a plot and give rise to Tree network effect on the crop. A class of variance balanced network designs for the estimation of direct as well as network effects of trees from adjacent plots has been obtained. An online software Web generation of Generalized Row-Column Designs (WebGRC) has been developed. Computer modules for generating four series of structurally incomplete GRC designs along with randomized layout have been developed.

Sampling methodology for estimation of postharvest losses of horticultural crops (fruits and vegetables) developed by ICAR-IASRI, New Delhi, India has been recommended and adopted by FAO, for conducting the field trials for estimating such losses. A small area estimation

methodology has been developed under a spatial version of multivariate Fay–Herriot model (which incorporates the correlation between variables of interest as well as spatial association between the small areas). The methodology has been applied to estimate the district level disparities in food and nutrition intake in rural areas of the state of Uttar Pradesh (combing the 2011-12 Household Consumer Expenditure Survey of the National Sample Survey Office and the 2011 Indian Population Census).

An efficient approach for detecting outlier in high dimensional genomic data has been proposed. The approach is p-value based combination methods to produce single p-value for detecting the outliers. Robustness of our approach has been tested using simulated data through the evaluation measures like precision, recall etc. It has been observed that significant improvement in the performance of genomic prediction has been obtained by detecting the outliers and handling them accordingly through our proposed approach using real data. A hybrid model based on Markov Switching GARCH and Extreme Learning Machine (MS-GARCH – ELM) for agricultural price volatility forecasting in the presence of structural break has been proposed. The performance of the proposed MS-GARCH – ELM model is compared with the existing models. For the forecasting of agricultural commodity prices having long memory property as well as structural break, a hybrid model based on ARFIMA with dummy variable and extreme learning machine has been proposed. It exploits the strength and feature of ARFIMA model as well as Extreme Learning Machine.

A machine learning-based method for prediction of GIGANTEA proteins has been developed. The Cloud Hardware Infrastructure and Software Services namely, KRISHI-MEGH, as a step forward towards digital agriculture of the 'New India' has been commissioned and launched. "ISS Web Portal" sample survey solutions for major livestock products (Milk, Meat, Egg and Wool) has been developed. Several R packages have been developed and uploaded in CRAN or GitHub repository.

Various training programmes were also conducted during the year. Of these, two were Centre of Advanced Faculty Trainings, two Winter Schools, two were conducted under Human Resource Management. Apart from these trainings, the other training programmes (including two training programmes conducted for Indian Statistical Service Probationers of the Government of India) were 31 in number. The Institute has published 173 research papers in National and International refereed Journals along with other publications.

Our senior level Scientists who also perform other key roles like ADG (ICT) and ICAR National Fellow have brought recognitions to our institute by way of serving as Expert Members in various high level committees, delivering invited talks in prestigious conferences and Co-chairing a session in international conference.

I would like to express my gratitude to Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR) for his invaluable guidance, encouragement and support. I am grateful to Dr. R.C. Agrawal, DDG (Agricultural Education), ICAR; Dr. P.S. Pandey, ADG (EP&HS), ICAR and Dr. G. Venkateshwarlu, ADG (EQA&R), ICAR for their constant direction,

inspiration and support. 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 Annual Report are highly appreciated. I wish to express my sincere thanks to all my colleagues in PME Cell, in particular, Dr. Ajit, PME In-charge for all the efforts and coordinating various activities. The sincere efforts of Dr. Ramasubramanian V., Principal Scientist who was also involved in Annual Report preparation is praiseworthy.

I am hopeful that the scientists in NARES/NASS 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.

(Rajender Parsad)
Director

Chapter 1
Executive Summary

Developing/strengthening/updating statistical methodologies/ techniques/ tools

- **Methods of construction** for obtaining pairwise and/or variance balanced **SIRC** (Structurally Incomplete Row-Column)/**BILS** (Balanced Incomplete Latin Square) designs have been obtained using symmetric BIB designs, union of two variance balanced SIRC/BILS designs or adding treatments in existing variance balanced SIRC designs. An R code for generating the information matrix given the layout of the design has also been given.
- **In agroforestry experiments**, different species of trees may interact spatially and experimental plots may be connected through a network of trees which would create non-directional adjacency effects on a plot and give rise to Tree network effect on the crop. A **class of variance balanced network designs for the estimation of direct as well as network effects of trees** from adjacent plots has been obtained.
- An online software Web generation of Generalized Row-Column Designs (**WebGRC**) has been developed. Computer modules for generating four series of structurally incomplete GRC designs along with randomized layout have been developed.
- Sampling methodology for **estimation of postharvest losses of horticultural crops (fruits and vegetables)** developed by ICAR-IASRI, New Delhi, India **has been recommended and adopted by FAO**, for conducting the field trials for estimating such losses.
- A **small area estimation methodology** has been developed under a spatial version of multivariate Fay–Herriot model (which incorporates the correlation between variables of interest as well as spatial association between the small areas). The methodology has been applied to estimate the district level disparities in food and nutrition intake in rural areas of the state of Uttar Pradesh (combing the 2011-12 Household Consumer Expenditure Survey of the National Sample Survey Office and the 2011 Indian Population Census).
- An **efficient approach for detecting outlier in high dimensional genomic data** has been proposed**.** The approach is p-value based combination methods to produce single p-value for detecting the outliers. Robustness of our approach has been tested using simulated data through the evaluation measures like precision, recall etc. It has been observed that significant improvement in the performance of genomic prediction has been obtained by detecting the outliers and handling them accordingly through our proposed approach using real data.
- A hybrid model based on Markov Switching GARCH and Extreme Learning Machine (**MS-GARCH – ELM**) for agricultural price volatility forecasting in the presence of structural break has been proposed. The performance of the proposed MS-GARCH – ELM model is compared with the existing models.
- For the forecasting of agricultural commodity prices having long memory property as well as structural break, a hybrid model based on ARFIMA with dummy variable and extreme learning machine has been proposed. It exploits the strength and feature of ARFIMA model as well as Extreme Learning Machine
- A supervised learning based methodology named as "**ASRpro**" for multi-label prediction of abiotic stress responsive proteins has been developed and is available online at https://github.com/meher861982/ASRpro.

Developing/strengthening/updating Web-server/Database/ information-system/Computational and bioinformatics tools

- A machine learning-based method for prediction of GIGANTEA proteins has been developed. Based on the proposed model, the web server "**GIpred**" has been established which is accessible at http://cabgrid.res.in:8080/gipred/.
- Developed a web server "**miRNALoc**" for predicting localization of miRNAs. The server is freely accessible at http://cabgrid.res.in:8080/mirnaloc/.
- A database "**FMDISC**", which is an information system on Foot and Mouth disease of cattle.
- Water Buffalo Mastitis Database (**WBMSTDb**): This web resource catalogues the information of mastitis associated genes, their annotation, functions, pathways, SNPs and INDELS in buffalo
- **KRISHI-MEGH**: The Cloud Hardware Infrastructure and Software Services, as a step forward towards digital agriculture of the 'New India' has been commissioned and launched.
- Developed **Accreditation-Portal** for on-line accreditation of Higher Agricultural Educational Institutions
- Developed **Krishi-Vishvidhyala-Chatra-Alumni-Network** (Alumini-Portal)
- Developed **Black Pepper Drought Transcriptome Database** (BPDRTDb)
- Implementation of **E-Office in ICAR**
- "**ISS Web Portal**" sample survey solutions for major livestock products (Milk, Meat, Egg and Wool) has been developed and is available at https://iss.icar.gov.in. Thirty five states/UTs have successfully logged in using the provided credentials.

Developing R-packages/SAS-macros

- **OGS**: Outlier in Genomics Data, GitHub repository.
- **EDI**: Calculation of Effective Drought Index (EDI), GitHub repository. This package computes the Effective Drought Index (EDI) from a time series daily or monthly precipitation data. Available at https://github.com/rrk4910/EDI .
- **IGST**: Informative Gene Selection Tool. R package version 0.1.0.
- "**PredCRG**" for prediction of circadian proteins encoded by circadian genes.
- "**BayesARIMAX**" to estimate the ARIMAX model using Bayesian framework. This package estimates ARIMAX model under Bayesian framework. Metropilis-Hasting algorithm has been used to generate the posterior density of the model parameters. The prior distributions of the parameters are assumed to be normally distributed. This package will result in Bayesian parameter estimates along with different convergence measures of the algorithm used. The package is available in public domain and can be downloaded at https://CRAN.R-project.org/package=BayesARIMAX.
- A machine learning-based method for prediction of GIGANTEA proteins has been developed. Based on the proposed model, the web server "**GIpred**" has been established which is accessible at http://cabgrid.res.in:8080/gipred/.
- **TEnGExA** : Classifies the user provided gene lists into tissue-enriched or tissue-specific transcripts along with other standard classes.
- **WaveletGARCH**: Fit the Wavelet-GARCH Model to Volatile Time Series Data. The package fits the combination of Wavelet-GARCH model for time series forecasting using algorithm by Paul (2015). It decomposes the volatile series into details and smooth components using selected wavelet filters followed by applying suitable

ARIMA or GARCH model to the decomposed series based on the pattern examined in the decomposed series using appropriate statistical tests. Finally the prediction is computed using inverse wavelet transform.

- "**MSGARCHelm**": Hybridization of MS-GARCH and ELM Model. It implements the three parallel forecast combinations of Markov Switching GARCH and extreme learning machine model along with the selection of appropriate model for volatility forecasting. Available at https://CRAN.R-project.org/package=MSGARCHelmm
- "**SBAGM**": To Search Best ARIMA, GARCH, and MS-GARCH Model. This package helps to find the most appropriate autoregressive integrated moving average, generalized auto-regressive conditional heteroscedasticity and Markov switching GARCH model. Available at https://CRAN.R-project.org/package=SBAGMM

Certificate, Post Graduate and Doctoral programmes

The Institute continued to conduct 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. During the period, in all, 5 and 7 students respectively completed their M.Sc. and Ph.D. courses in Agricultural Statistics; 3 and 6 students respectively completed their M.Sc. and Ph.D. courses in Computer Application; 1 and 5 students respectively completed their M.Sc. and Ph.D. courses in Bioinformatics.

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 course was organized during the period September 28, 2020 to March 08, 2021.

The Annual Day of the Institute was celebrated in online mode on July 02, 2020 in which Dr. DVV Ramana, Professor, Preventive Medicine, Health and Biomedical Informatics Division, Feinberg School of Medicine, Northwestern University, USA delivered the Nehru Memorial Lecture entitled "Statistical Pattern Recognition and Machine Learning Applications in Life Science Research". Dr. Trilochan Mohapatra, Secretary, DARE & DG, ICAR was the Chief Guest. The Teacher's Day was celebrated on September 05, 2020 in which Dr. R. C. Agrawal, DDG (Education) delivered lecture on the topic of New National Education Policy.

Training programmes

Various training programmes were also conducted during the year. Of these, two were Centre of Advanced Faculty Trainings, two Winter Schools, two were conducted under Human Resource Management. Apart from these trainings, the other training programmes (including two training programmes conducted for Indian Statistical Service Probationers of the Government of India) were 31 in number.

Research projects

During the year, 35 in-house projects were carried out, out of which 20 were ongoing, 10 projects got completed and 5 were newly initiated; 50 externally funded projects were carried out, out of which 27 were ongoing, 17 projects got completed and 6 were newly initiated. Apart from these 85 projects, one consultancy project and one ICAR National Fellow Scheme project were also handled at our institute.

Chapter 2
Introduction

ICAR-Indian Agricultural Statistics Research Institute (IASRI) is a pioneer and premier 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 9001:2015 certificate in the year 2018. ICAR Data Centre established at ICAR-IASRI acquired the certification for ISO/IEC 20000 & ISO/IEC 27001 in October, 2015. ISO 20000:2011 & ISO 27001:2013. External Surveillance Audit was successfully completed at ICAR Data Centre on September 19, 2016 and it was recommended for continuation of the ISO 20000-1:2011 & ISO 27001:2013 standard by the BSI.

- 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 &useful contributions to research in Agricultural Statistics and Informatics in the fields like Design of Experiments, Statistical Genetics, Forecasting Techniques, Statistical Modelling, Sample Surveys, Econometrics, Computer Applications in Agriculture, Software Development, Agricultural Bioinformatics 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.

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 with 192 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.

ICAR Data Centre was inaugurated by Union Minister of Agriculture and Farmers' Welfares at IASRI on 21st December, 2016. About 80 website have been launched in Data Centre.

Krishi Vigyan Kendra Knowledge Network Portal and KVK Mobile APP (http://kvk.icar.gov.in) have been developed to disseminate knowledge and information from KVKs to farmers. KVK Portal was launched on 8th July 2016 and KVK Mobile APP was launched on 21st December, 2016 by the Union Minister of Agriculture and Farmers Welfare.

Honourable Union Minister of Agriculture and Farmers' Welfare released the Education portal of ICAR along with two Mobile Apps namely Pashu Prajanan (Animal Reproduction) and Shukar Palan (Pig Farming) in the Conference of Vice Chancellor of Agricultural Universities and Directors of ICAR Institutes on 8th March, 2018 at NAAS Complex, Pusa, New Delhi. Mobile Apps Pashu Prajanan and Shukar Palan have been developed in collaboration with ICAR-IVRI and is available on Google Play Store. Four copyrights have been obtained for Animal Reproduction and Pig Farming mobile apps for different languages.

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 housekeeping 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

- Prioritization, 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 is furnished below:

Expenditure Statement (detailed) (Rs. In Lakhs) **(April, 2020 – March, 2021)**

S. No.	Head	Allocation Govt.Grant 2020-21	Allocation Internal Resource + Additional amount provided by HQ out of Council's share(2020-21)	TOTAL ALLOCATION 2020-21	Expenditure (Govt.Grant) 2020-21				Expenditure(Revenue Generation)2020-21	TOTAL EXPENDITURE 2020-21
1	2	3	4	5 (3 + 4)	6				7	8
					NEH	TSP	SCSP	Other than NEH & TSP		
1	Works									
	A. Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B. Building	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	i. Office building	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ii. Residential building	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	iii. Minor Works	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Equipment	6.00	23.91	29.91	0.00	0.00	21.10	4.06	0.00	25.16
3	Information Technology	14.00	0.00	14.00	0.00	0.00	0.00	10.79	0.00	10.79
4	Library Books and Journals	64.60	0.00	64.60	0.00	0.00	0.00	64.38	0.00	64.38
5	Vehicles & Vessels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Livestock	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Furniture & fixtures	2.40	0.00	2.40	0.00	0.00	0.00	2.39	0.00	2.39
8	Others	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total – CAPITAL (Grants for creation of Capital Assets)	87.00	23.91	110.91	0.00	0.00	21.10	81.63	0.00	102.73

		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	Establishment Expenses(Salaries)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	i. Establishment Charges	2829.00	0.00	2829.00	0.00	0.00	0.00	2816.89	0.00	2816.89
	ii. Wages	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	iii. Overtime Allowance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total – Establishment Expenses (Grant in Aid - Salaries)	2829.00	0.00	2829.00	0.00	0.00	0.00	2816.89	0.00	2816.89
1	Pension & Other Retirement Benefits	714.90	0.00	714.90	0.00	0.00	0.00	714.68	0.00	714.68
2	T.A.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	A. Domestic TA / Transfer TA	7.00	0.00	7.00	0.00	0.00	0.00	6.48	0.00	6.48
	B. Foreign TA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total – Traveling Allowance	7.00	0.00	7.00	0.00	0.00	0.00	6.48	0.00	6.48
3	Research & Operatinal Expenses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	A. Research Expenses	303.83	0.00	303.83	0.00	0.00	0.00	303.83	0.00	303.83
	B. Operational Expenses	125.17	0.00	125.17	0.00	0.00	0.00	120.71	0.00	120.71
	Total - Research & Operational Expenses	429.00	0.00	429.00	0.00	0.00	0.00	424.54	0.00	424.54
4	Administrative Expenses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	A. Infrastructure	462.00	17.74	479.74	0.00	0.00	17.70	461.38	0.00	479.08
	B. Communication	3.00	0.00	3.00	0.00	0.00	0.00	2.18	0.00	2.18
	C.Repair & Maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	i. Equipments,Vehicles & Others	923.65	102.00	1025.65	0.00	0.00	97.39	917.56	0.00	1014.95
	ii. Office building	60.40	0.00	60.40	0.00	0.00	0.00	59.44	0.00	59.44
	iii.Residential building	19.00	0.00	19.00	0.00	0.00	0.00	16.13	0.00	16.13
	iv. Minor Works	4.50	0.00	4.50	0.00	0.00	0.00	4.42	0.00	4.43
	D. Others (excluding TA)	173.99	31.99	205.99	0.00	0.00	28.93	167.77	0.00	196.70
	Total - Administrative Expenses	1646.55	151.74	1798.29	0.00	0.00	144.02	1628.90	0.00	1772.92

5	Miscellaneous Expenses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	A. HRD	2.10	0.00	2.10	0.00	0.00	0.00	2.10	0.00	2.10
	B. Other Items (Fellowships, Scholarships etc.)	120.52	41.40	161.92	0.00	0.00	41.40	120.52	0.00	161.92
	C. Publicity & Exhibitions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D. Guest House – Maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E. Other Miscellaneous	102.83	0.00	102.83	0.00	0.00	0.00	102.83	0.00	102.83
	Total - Miscellaneous Expenses	225.45	41.40	266.85	0.00	0.00	41.40	225.45	0.00	266.85
	Total --Grants in Aid - General	3022.90	193.14	3216.04	0.00	0.00	185.42	3000.05	0.00	3185.47
	Grand Total (Capital + Establishment+General)	5938.90	217.05	6155.95	0.00	0.00	206.52	5898.56	0.00	6105.08
6	Non Interest Bearing Advances	0.00	0.00	0.00	0.00	0.00	0.00	1.41	0.00	1.41
										(Rs. In Lakhs)
	Swachh Bharat Mission									98.94

Chapter 3
Research Achievements

Latin Hypercube Designs:

Latin hypercube designs (LHDs) are commonly used in designing complex computer models. A new type of Latin hypercube design known as Sliced LHD (SLHD) are now a days are gaining importance in the field of computer experiments. SLHDs are a special type of LHDs, which can be further partitioned into different slices and act as batches of smaller Latin hypercube designs. **Developed methods of construction of sliced Latin hypercube designs** and **sliced orthogonal Latin hypercube designs** with both equal and unequal batch (slice) for up to three slices.

Machine Learning Techniques based Hybrid Model for Forecasting in Agriculture

Agricultural dataset are mostly nonlinear, nonstationary and leptokurtic in nature. These properties of dataset pose a variety of problems in forecasting. Precise forecasting helps both farming community and policy makers to undertake informed decisions. Three different hybrid models *i.e.* empirical mode decomposition based support vector regression (EMD-SVR), time delay neural network with error correction term (TDNN-ECT) and multivariate adaptive regression splines based artificial neural network (MARS-ANN) models have been proposed. The EMD-SVR model has the capability of smoothing and reducing the noise (inherited from EMD) and the capability of filtering dataset and improving forecasting performance (inherited from SVR).TDNN-ECT uses the error correction term from the two co-integrated series as auxiliary variable. The auxiliary information in the form of ECT improves the forecasting accuracy. MARS-ANN hybrid model was developed in which the MARS algorithms was employed to extract important factors determining crop yield and the extracted factors were used for yield prediction using ANN methodology. The performance of proposed hybrid models was evaluated with individual forecasting models using three different agricultural datasets. The results indicated that the performances of the proposed hybrid models are substantially superior as compared to the individual forecasting model.

Regression Analysis from Sample Survey Data using Calibration Approach

The calibration approach is commonly employed in survey estimation to modify the sampling design weights using auxiliary information to produce efficient estimator for the finite population parameters. Efficient estimator of regression coefficients have been developed by extending the calibration approach. In particular, calibrated estimators are developed based upon the auxiliary variable(s) correlated with the dependent and/or explanatory variable. The estimators of variance of proposed estimators are also developed using two approaches namely, analytical and bootstrap. The performance of the proposed estimators along with its corresponding variance estimators are evaluated through simulation studies. The empirical results based on simulation studies using both synthetic population and real data show that the developed estimators perform better than the existing estimator. Further, the empirical results reveal that both analytical and bootstrap variance estimators perform reasonably well.

Robust Technique of Association for Genome Wide Case-Control Study

Analysis of SNPs and haplotypes offer a promising new research avenue for finding association of genes with complex diseases. Haplotypes are SNPs which are linked

together in a chromosome and are inherited together. Prospective and retrospective likelihoods are the two common approaches used to study this association in case of SNPs. A method based on Preliminary test has been proposed for SNPs, which is efficient than prospective approach by exploiting model assumptions of Hardy Weinberg Equilibrium (HWE) and robust against failure of model assumptions as compared to retrospective approach. Association analysis using haplotypes is also gaining importance. Model-free and model-based methods are the two commonly followed approaches for the analysis of haplotype data. A Preliminary Test Estimator for the analysis of haplotype data has been proposed by utilizing model free and model based method.

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

Food security is one of the highest priorities of the Government of India to achieve the Sustainable Development Goal 2 (SDG-2). In India, the estimates of food insecurity indicators are not available at local area or small/lower administrative units like at district level in the country because the sample sizes for such small areas in the existing large scale survey data are often very small or even zero. The small area estimation (SAE) methodology provides a viable and cost effective solution to this problem of small sample sizes at lower administrative level. The SAE method is applied to estimate the incidence of food insecurity in different districts of rural areas of the state of Uttar Pradesh by linking data from the latest available 2011-12 Household Consumer Expenditure Survey collected by the National Sample Survey Office of India and the 2011 Population Census. A map (Fig. 1) showing district level inequalities in the distribution of food insecure households in Uttar Pradesh is also produced which provides an important information for analysis of spatial distribution of food insecurity in the state.

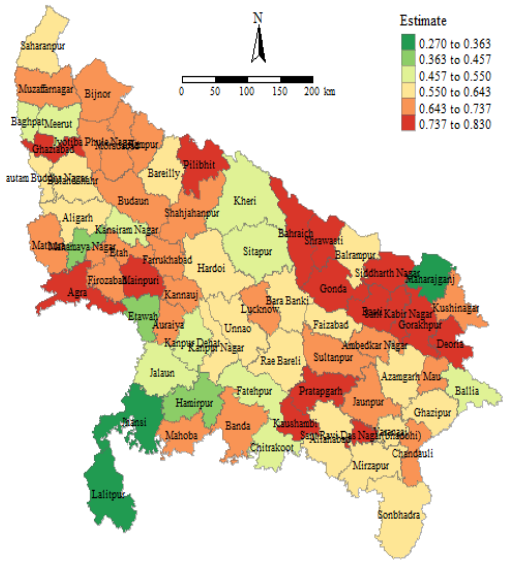

Figure-1: Spatial distribution of incidence of food insecurity by District in rural area of Uttar Pradesh.

Estimating the Sub-State Level Estimate of Socio-Economic Indicators of Uttar Pradesh Using Small Area Estimation Techniques: The disparities among the households both rural and urban areas with their standard of living in the state of Uttar Pradesh for different household categories such as land holding size and social group categories have been studied. The district-wise estimates of average household monthly per capita consumer and expenditure (MPCE) as well as the measure of reliability (defined by the percent coefficient of variation of the estimates) have been produced for different household categories for rural and urban areas. In the latest available 2011-12 Household Consumer Expenditure Survey data, a total of 5916 rural and 3102 urban households from the 71 districts of Uttar Pradesh were surveyed. The district sample sizes for rural areas ranged from 32 to 128 with average of 83. Similarly the district sample sizes for urban areas varied from 30 to 128 with average of 44. The district specific sample sizes reduce further in case of further disaggregation such as district by land categories etc. Therefore, it is difficult to generate reliable district level direct survey estimates with associated standard errors from this survey. This small sample size problem has been resolved by using small area estimation (SAE) approach. District-wise estimates of MPCE have also been obtained for both rural and urban sectors of Uttar Pradesh using SAE method. District-wise maps of average household MPCE (living condition) for both rural and urban sector of Uttar Pradesh have also been produced and given in Fig.2 and Fig.3. The results clearly indicate the disparities within the state with respect to different household categories. The results also identify the regions and household categories with low and high MPCE estimates.

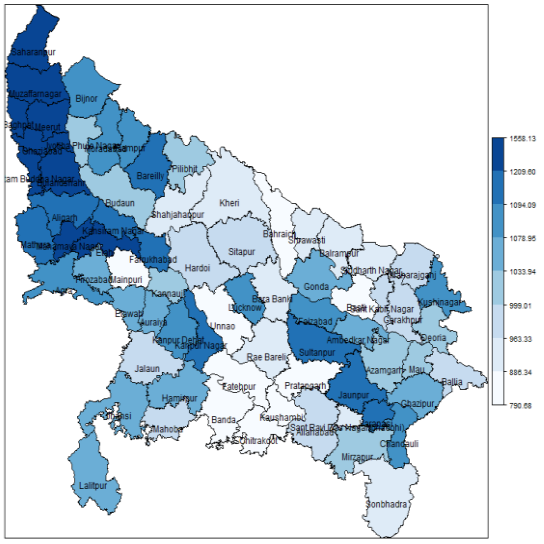

Figure-2: District-wise mapping of average household MPCE for rural areas of Uttar Pradesh.

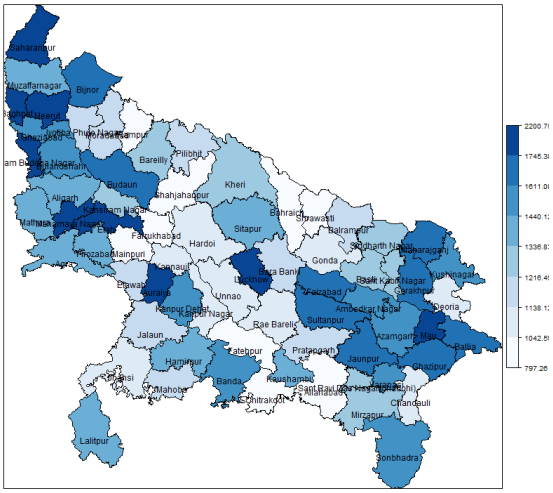

Figure-3: District-wise mapping of average household MPCE for urban areas of Uttar Pradesh.

Developing State Level Estimates of Crop Area and Production on the Basis of Sample Sizes Recommended by Professor Vaidyanathan Committee Report: A suitable sampling methodology for producing state level estimates of crop area and yield on the basis of sample sizes recommended by Professor Vaidyanathan Committee to

generate quick estimate of crop area and yield has been developed. Mobile Assisted Personal Interview (MAPI) software was also developed for collection of survey data using android smart phones in addition to traditional Paper Assisted Personal Interviewing (PAPI). Pilot survey has been implemented in five states namely Assam, Odisha, Uttar Pradesh, Karnataka and Gujarat. From the analysis of data of this survey, it has been found that MAPI is more efficient than PAPI both in terms of time and accuracy. The empirical results further reveal that sample size recommended by Committee is reasonable to provide the district level estimates of crop yield and the estimates are comparable with those generated through general crop estimation survey with larger sample size.

Integrated Sample Survey Solutions for Major Livestock Products

Towards providing integrated sample survey (ISS) solutions for major livestock products, a web portal, **ISS Web Portal (**(https://iss.icar.gov.in))(Fig.4) has been developed for four commodities (Milk, Meat, Egg and Wool) with three modules viz., sample selection module, data entry and analysis module and GIS map module. Sample selection moduile is fully functional which allows states to draw sample for complete enumeration and detailed survey for all three seasons (summer, rainy and winter) in a year according to the ISS methodology for estimation of production and number of all four livestock commodities (Milk, Meat, Egg, Wool)

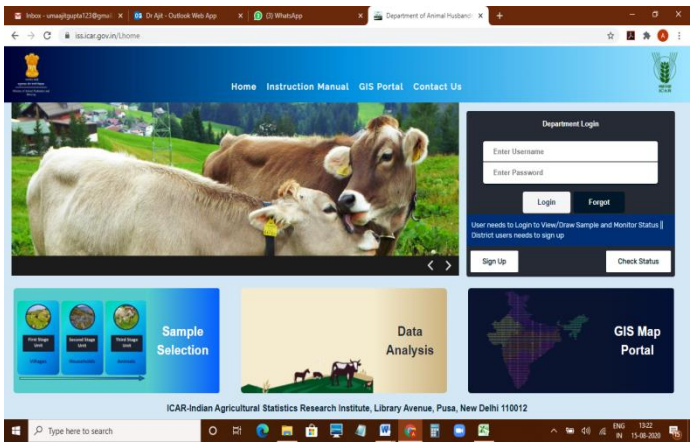

Figure-4: ISS Web Portal – Home/Login

R-packages Developed:

Following R-packages have been developed (i) **OGS**: Outlier in Genomics Data, GitHub repository (https://github.com/BudhlakotiN/OGS); (ii) **EDI**: Calculation of Effective Drought Index (EDI), GitHub repository (URL: https://github.com/rrk4910/EDI); (iii) **IGST**: Informative Gene Selection Tool (https://CRAN.R-project.org/package=IGST); (iv) **PredCRG:** for prediction of circadian proteins encoded by circadian genes (https://cran.r-project.org/web/packages/PredCRG/index.html); (v) **BayesARIMA:** to estimate the ARIMAX model using Bayesian framework (https://CRAN.R-project.org/package=BayesARIMAX); (vi) **varEst:** to estimate error variance of fitted genomic selection models from ultrahigh dimensional genomic datasets (https://CRAN.R-project.org/package=varEst); (vii) **GSelection**: contains seven functions to select important genetic markers and predict phenotype on the basis of fitted training data using integrated model framework(https://CRAN.R-project.org/package=GSelection); (viii) **STGS:** Genomic Selection using Single Trait using whole genome markers information to predict genetic merit of individuals in a practical breeding programme (https://CRAN.R-project.org/package=STGS) ; (ix) **MTGS**: Genomic Selection using Multiple Traits for genomic predictions by estimating marker effects (https://CRAN.R-project.org/package=MTGS)

Web Resources of Design of Experiments

For dissemination, e-learning and e-advisory in designed experiments, strengthened the Design Resources Server (https://drs.icar.gov.in) and other web resources.

- Developed following web resources as R Module for (a) Construction of Orthogonal and Nested Orthogonal Latin Hypercube Designs (http://drsr.icar.gov.in/OLH/) consisting of four different modules for generation of viz. (i) 1st order OLH design; (ii) 2nd order OLH design; (iii) Nested OLH design and (iv) OLH design with good space filling property and (b) Incomplete Split Plot Designs: Construction and Analysis (http://drsr.icar.gov.in/ISPD/). This web service gives facility to construct an incomplete split plot designs for three situations namely (i) when blocks are complete with respect to whole plot treatments and whole plots are incomplete with respect to subplot treatments, (ii) when blocks are incomplete with respect to whole plot treatments and whole plots are complete with respect to subplot treatments and (iii) when blocks are incomplete with respect to whole plot treatments and whole plots are incomplete with respect to subplot treatments. There is also facility to analyse data from experiments conducted using each of the above three types of incomplete split plot designs (Fig-5).
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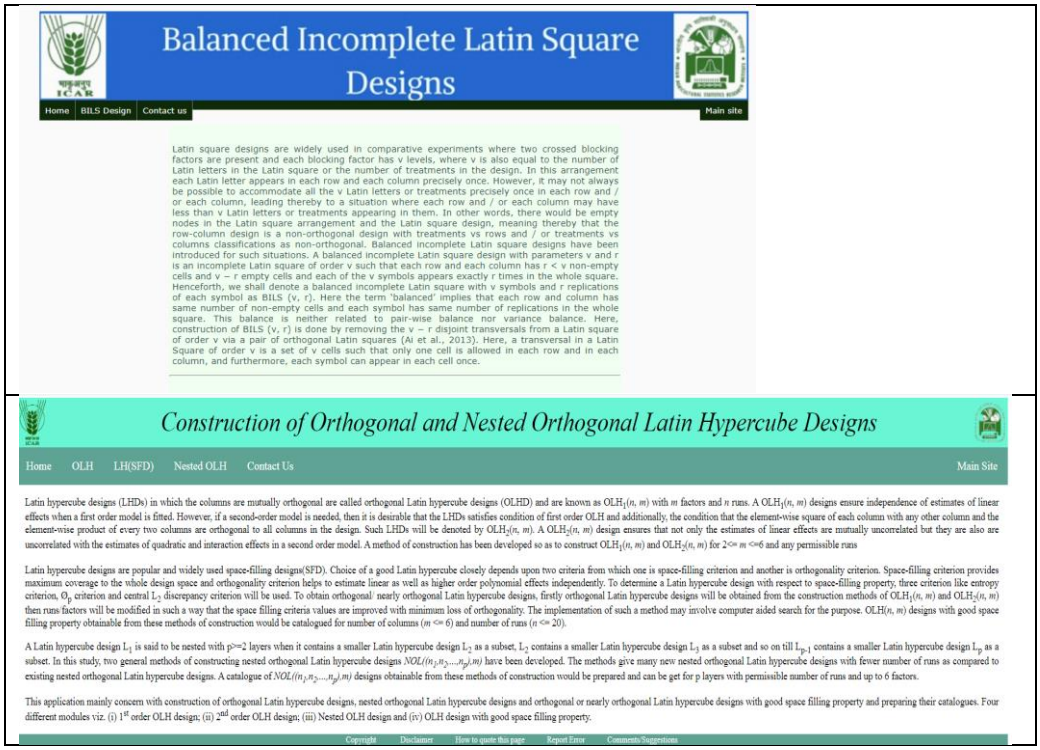

Figure-5: Screen-shots of Balanced-Incomplete-Latin-Square-Design and Latin-Hypercube designs

- Developed a module for online generation of Generalized Row-Column Designs (WebGRC). Computer modules for generating four series of structurally incomplete GRC designs along with randomized layout have been developed (Fig.-6).
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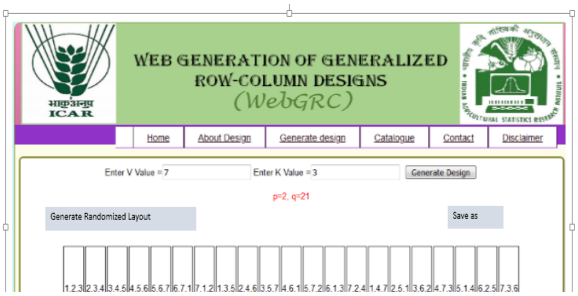


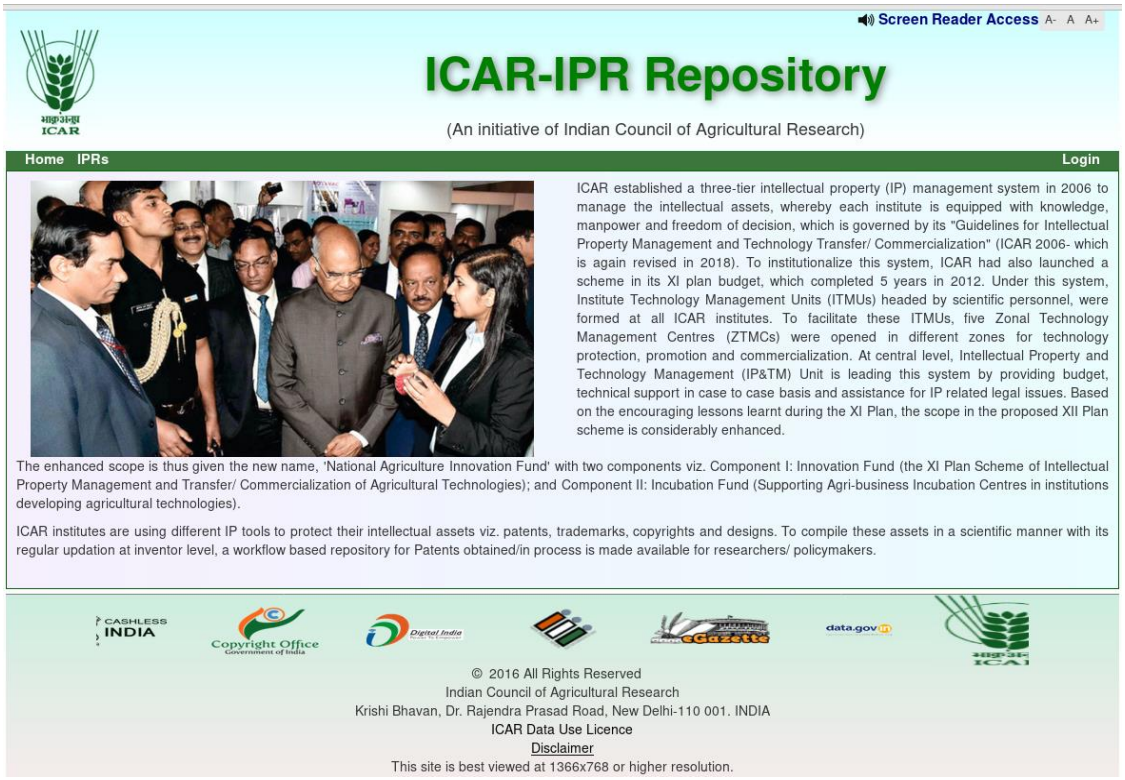
Figure-6: Screen-shot-of web generation of Generalized-Row-Column-Designs

Comparative Analysis of publications in Web of Science

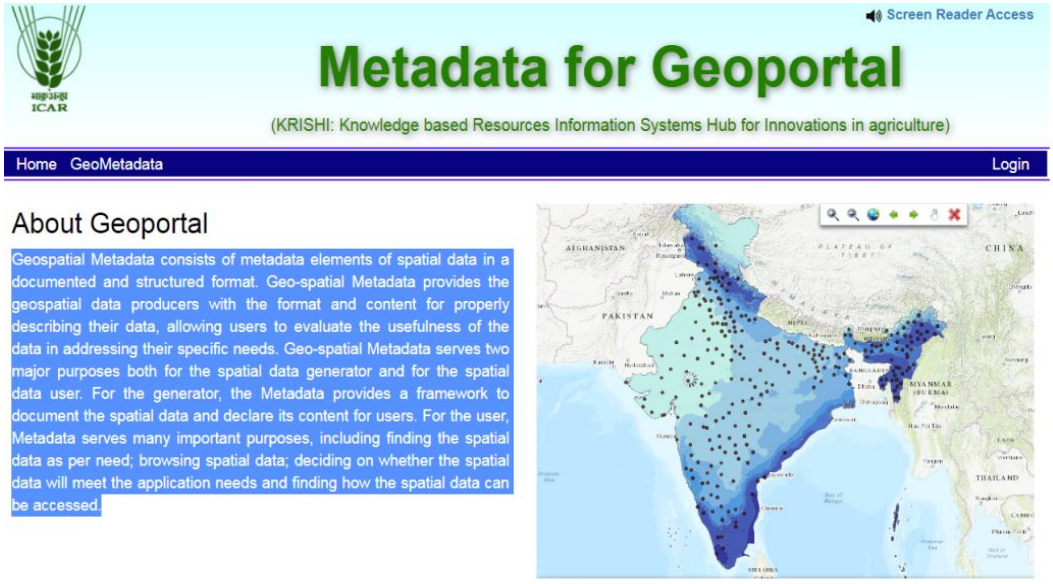
A comparative publication analysis of ICAR vis-a-vis CIMMYT, IRRI, ICRISAT, INRAE, France; CAAS, China; EMBRAPA, Brazil; AAFC, Canada and CSIRO, Australia *during 2010-2019 was carried out* using the data retrieved from Web of Science Core Collection Citation Indexes (http://webofknowledge.com) as on 16.04.2020 and 29.05.2020. *The report consisted of* number of publications, average citations, h-index year-wise as well as for two quinquennial periods (2010-14; 2015-19). The number of publications with at least 100 or 50 citations was obtained. This also includes comparison (a) based on 500 most cited papers each year, 1000 most cited papers and 2025 most cited papers; (b) Average citation(s) per publication of (i) 2000 publications by taking 200 most cited papers per year and (ii) 5000 publications by taking 500 most cited papers per year. The study was carried out by ICAR-IASRI and ICAR-NAARM jointly.

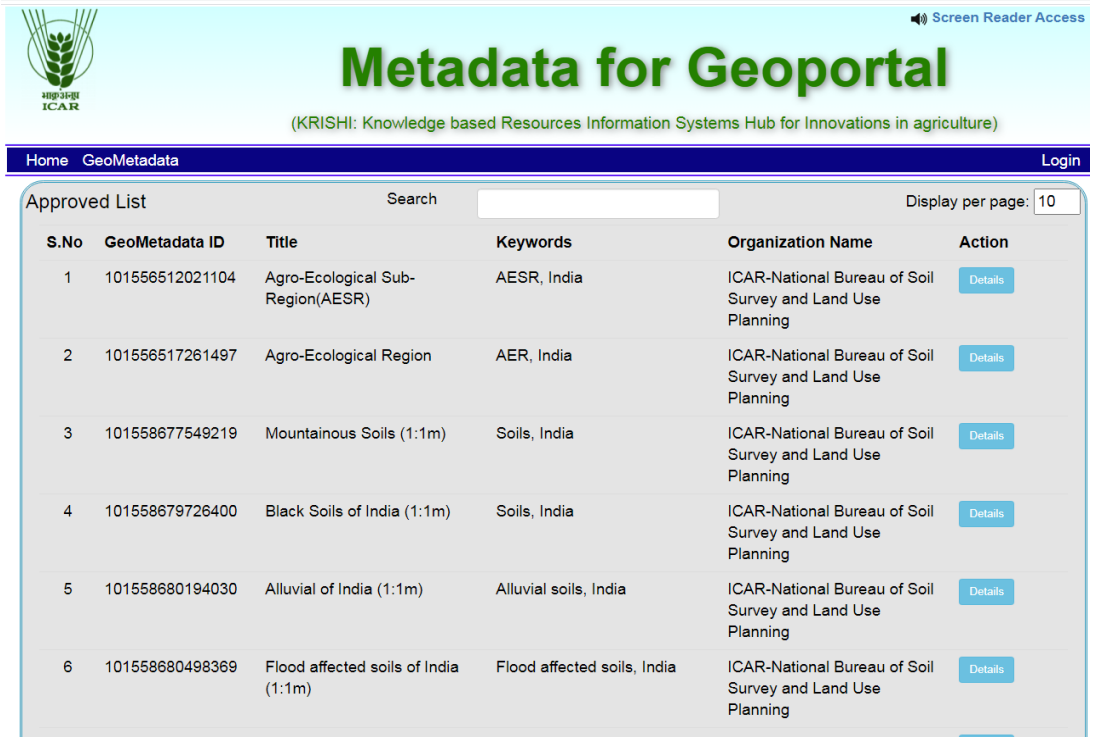
ICAR Research Data Repository for Knowledge Management as (**KRISHI-Agricultural Knowledge Resources and Information System Hub for Innovation**) portal is serving as a gateway to online resources available at different ICAR Institutes to enhance visibility and easy access of digital outputs of ICAR to stakeholders.

- Developed CMS based website of (1) **AICRP on Arid Zone Fruits** (https://aicrp.icar.gov.in/azf/); (2) AICRP on Potato (https://aicrp.icar.gov.in/potato/); (3) **AICRP on Pesticide Residues** (https://aicrp.icar.gov.in/Pesticide/) (4) **All India Network Project on Soil Biodiversity Biofertilizers** (https://aicrp.icar.gov.in/Biofertilizers); (5) **AICRP on Biological Control of Crop Pests and Diseases** (https://aicrp.icar.gov.in/biocontrol/); (6) **AICRP on Medicinal and Aromatic Plants including Betelvine** (https://aicrp.icar.gov.in/map/); (7) **All India Network Project on Honey Bee Research and Trai**ning (https://aicrp.icar.gov.in/honeybee/) and (8) **All India Coordinated Research Network on Potential Crops** (https://aicrp.icar.gov.in/potentialcrop/); (9) **AICRP on Tobacco** (https://aicrp.icar.gov.in/tobacco/); (10) **AICRP on Groundnut** (https://aicrp.icar.gov.in/gnut/); (11) **AICRP on STCR** (https://aicrp.icar.gov.in/stcr/); (12) **AICRP on Nematode** (https://aicrp.icar.gov.in/nematodes/); (13) **AICRP on Agroforestery** (https://aicrp.icar.gov.in/Agroforestry/); (14) **AICRP on Goat** (https://aicrp.icar.gov.in/goat/); (vii) **AICRP on Castor, Safflower and Sunflower** (https://aicrp.icar.gov.in/css/); and hosted on KRISHI Portal.
- **Information Systems for AICRPs:** Developed Information System for i) AICRP on Pearl millet and (ii) AICRP on Castor, Safflower and Sunflower; (iii) AICRP on Small Millets to plan and design experiments, generate data, analyze data and prepare report of AICRP experiments. It is also useful for creation of research data repository and standardization of analysis and reporting of experiments.
- **ICAR IPR Repository:** ICAR institutes are using different IP tools to protect their intellectual assets viz. patents, trademarks, copyrights and designs. To compile intellectual assets in a scientific manner with its regular update at inventor level, developed an integrated workflow based application on Patents, Copyrights and Varieties registered with PPVFRA

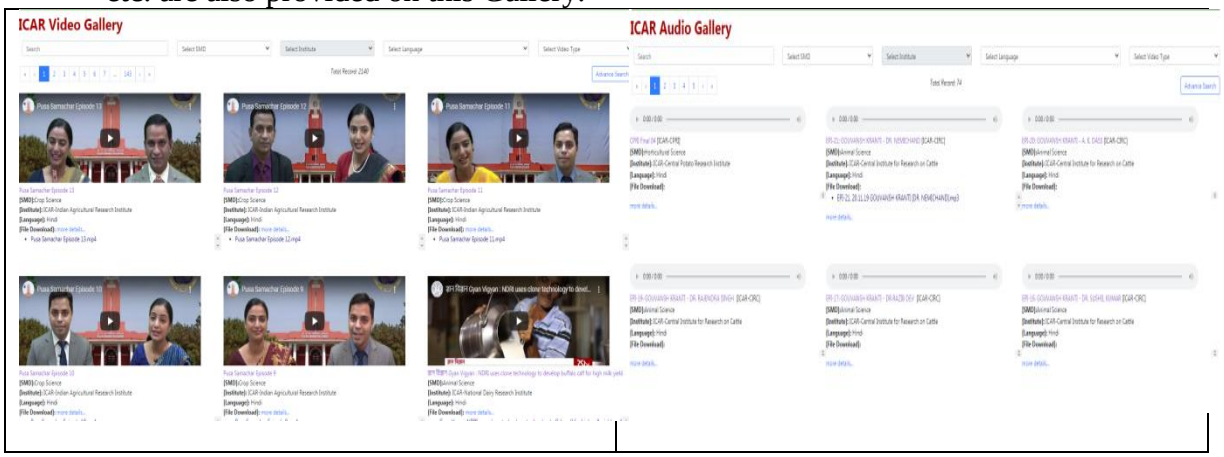


- **Spatial Meta Data Repository:** Geospatial Metadata consists of metadata elements of spatial data in a documented and structured format. Geo-spatial Metadata provides the geospatial data producers with the format and content for properly describing their data, allowing users to evaluate the usefulness of the data in addressing their specific needs. Geo-spatial Metadata serves two major purposes both for the spatial data generator and for the spatial data user. For the generator, the Metadata provides a framework to document the spatial data and declare its content for users. For the user, Metadata serves many important purposes, including finding the spatial data as per need; browsing spatial data; deciding on whether the spatial data will meet the application needs and finding how the spatial data can be accessed. Developed a workflow based application for geo-metadata.





- **ICAR Video and Audio Gallery:** For providing single window access of all the videos, audios, mobile apps of ICAR Institutes, developed version 2 of (i) ICAR Video Gallery, (ii) ICAR Audio Gallery and (iii) Mobile App Galleries separately using Angular JS with CAS Spring web App and hosted at https://krishi.icar.gov.in/video; https://krishi.icar.gov.in/audio and https://krishi.icar.gov.in/mobileapp/ respectively. At present 2000+ videos, 70+ Audios and 250+ mobile apps are available in this gallery. Search can be made using keyword(s) or SMD, Institute and language with drop down filters. Links of the videos of CG Centres; AAFC, Canada; CAAS, China; Emprapa, Brazil, INRAE, France; CSIRO, Australia; DD KISAN; KRISHI Darshan, etc. are also provided on this Gallery.

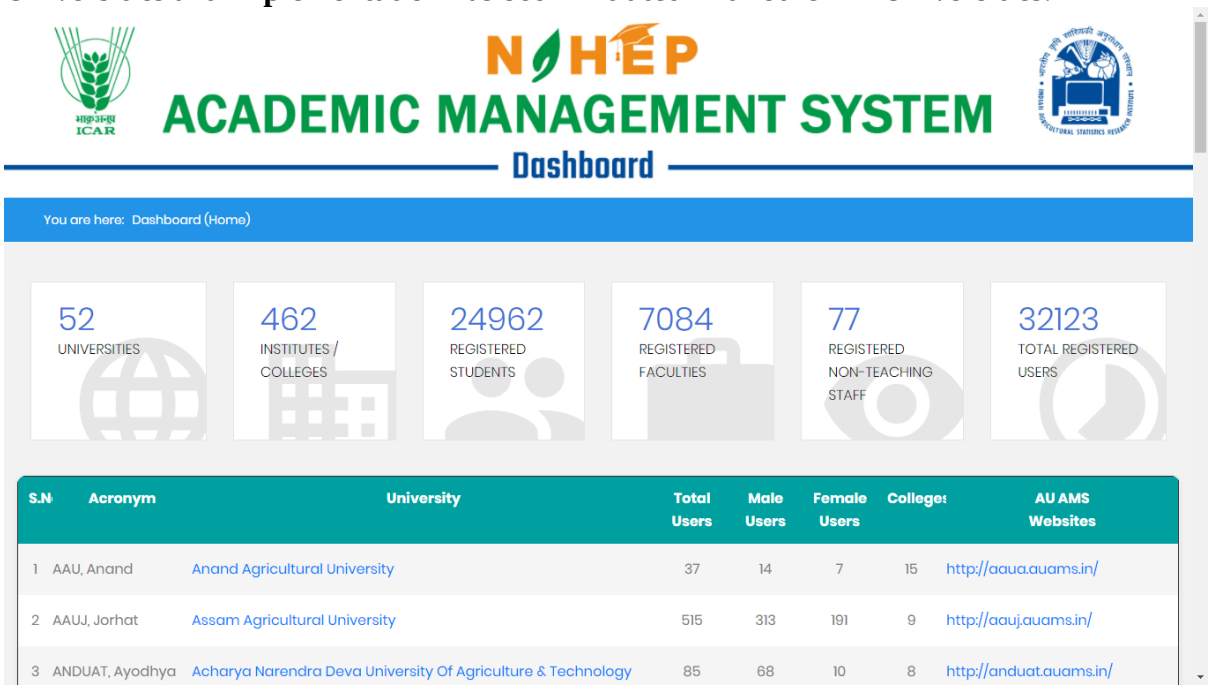


The Hon'ble President of India, Shri Ram Nath Kovind virtually conferred the Indian Council of Agricultural Research, New Delhi with the *"**Digital India Awards–2020 (***Ministry of Electronics and Information Technology (MEITY), Govt. of India)*"* under the *Open Data Champion category* today. The ICAR was felicitated with the **Gold Icon** Award for its ***Research Data Management Portal***. This portal is developed, strengthened and maintained by ICAR-IASRI as lead centre in partnership with other Institutes. The Open Data Champion

Award is to acknowledge the Ministries/Departments/ Organizations/States for proactive, timely and regular release of datasets / resources through Web Services/APIs on the Open Government Data (OGD) Platform (https://data.gov.in) in compliance with the National Data Sharing and Accessibility Policy (NDSAP). The Indian Council of Agricultural Research is committed for organizing its knowledge and making it available to the fullest extent possible through Open Government Data Platform (https://data.gov.in) and its own Portal- KRISHI (Agricultural Knowledge Resources and Information System Hub for Innovations) Portal (https://krishi.icar.gov.in). The Portal has been developed by ICAR-IASRI as a centralized data repository system for Research Data Management in the Council.

Academic Management System (AMS)

Academic Management System (AMS) Version 2.0 has been developed and customized under the NAHEP Component 2 for its implementation at various Agriculture Universities. It is a web enabled system for management of all the various academic activities of the University. The system caters to the needs of different users: Dean, Registrar, Professor, Head, Guide, Faculty, Teacher, Student, Administrators and Officials for performing their assigned tasks. The system has been designed in a modular approach with in-built work flows. System ensures that the individuals responsible for the next task are notified and receive the data they need to execute at their stage of process. At present five modules have been envisaged viz., Student Management, Faculty Management, Course Management, Administration Management and E-Learning. Thus, AMS facilitates in automation of various academic processes of the University and enhances the transparency and efficiency of the overall system by saving time and efforts involved in manual processes. At present, the system has been **operational in 30 Agriculture Universities** and **implementation** has been **initiated in another 22 Universities**.

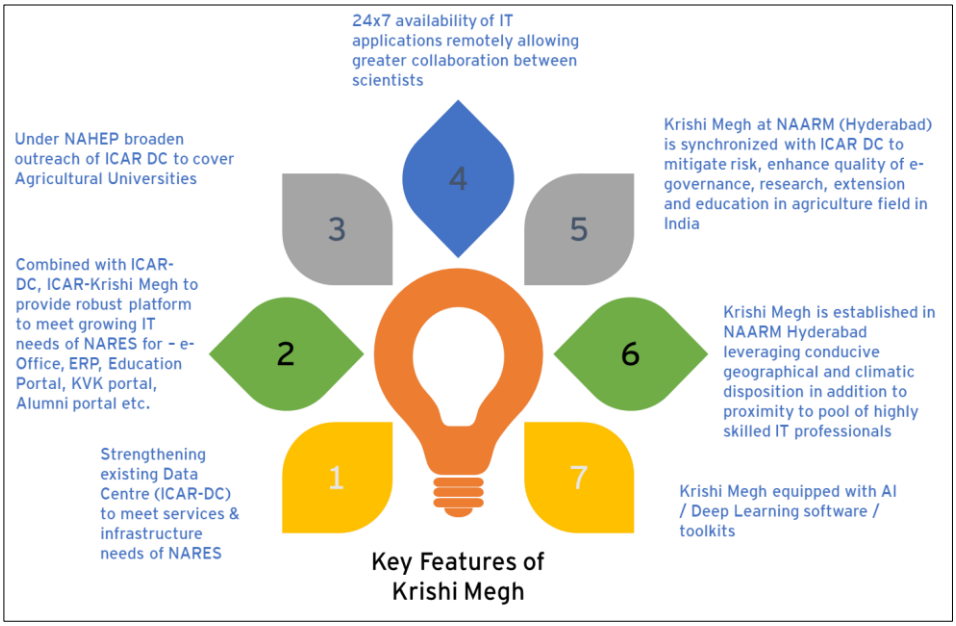


KRISHI-MEGH (NARES Cloud Infrastructure and Services)

With the endeavour to modernize and digitize the agricultural sector in the country, the National Agricultural Research & Information System- Cloud Infrastructure and Services named KRISHI-MEGH has been initiated. This platform is established by ICAR-IASRI under the ICAR-World Bank's National Agricultural Higher Education Project's (NAHEP) with the core objectives of improving access of Agricultural Universities to the ICAR Data Centre using sophisticated IT solutions.

Krishi Megh has been strategically established at NAARM, Hyderabad, due to its suitable geographical and climatic disposition. Krishi Megh integrates the ICAR Data Centre at ICAR-Indian Agricultural Statistics Research Institute (IASRI), New Delhi with the Disaster Recovery Centre at the ICAR-National Academy of Agricultural Research Management (NAARM), Hyderabad. The platform is equipped with latest Artificial Intelligence (AI)/Deep-Learning Software/toolkits that enable development and execution of deep learning-based applications for agricultural research and development in the country.

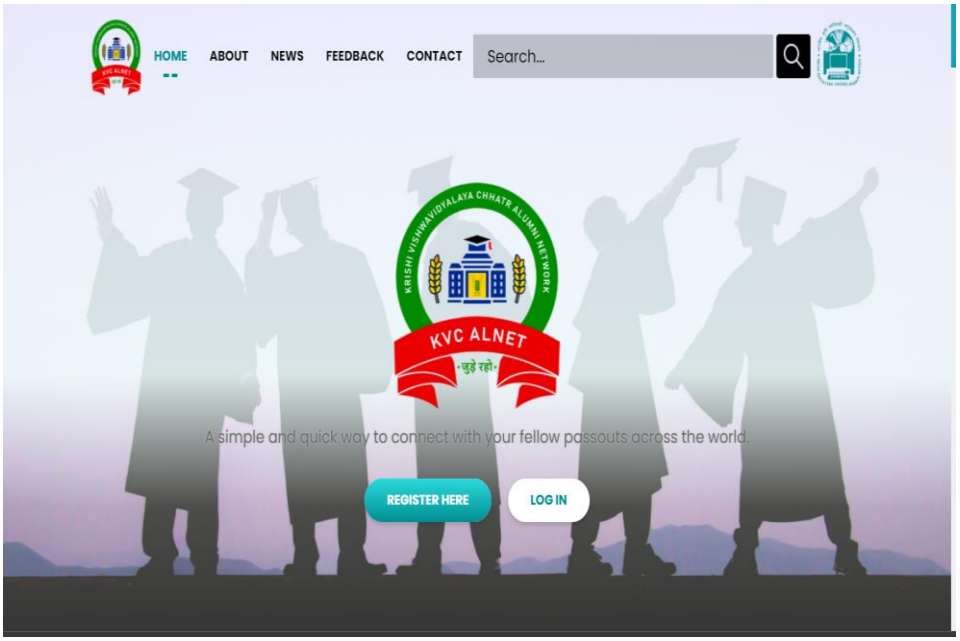
Union Minister of Agriculture & Farmers Welfare launched Krishi Megh. The platform has been well received and is also in consonance with the New Education Policy 2020 that beckons provision of relevant and high-quality educational resources to Agricultural University students in India.



Krishi Vishwavidyalaya Chhatr Alumni Network – KVC ALUNET

Krishi Vishwavidyalaya Chhatr Alumni Network – KVC ALUNET has been developed by ICAR-IASRI under NAHEP-component-2. This digital alumni platform will foster the development of a vibrant multicultural Alumni association wherein alumni can contribute towards strengthening their existing networks, interact in real time and participate in university level events.

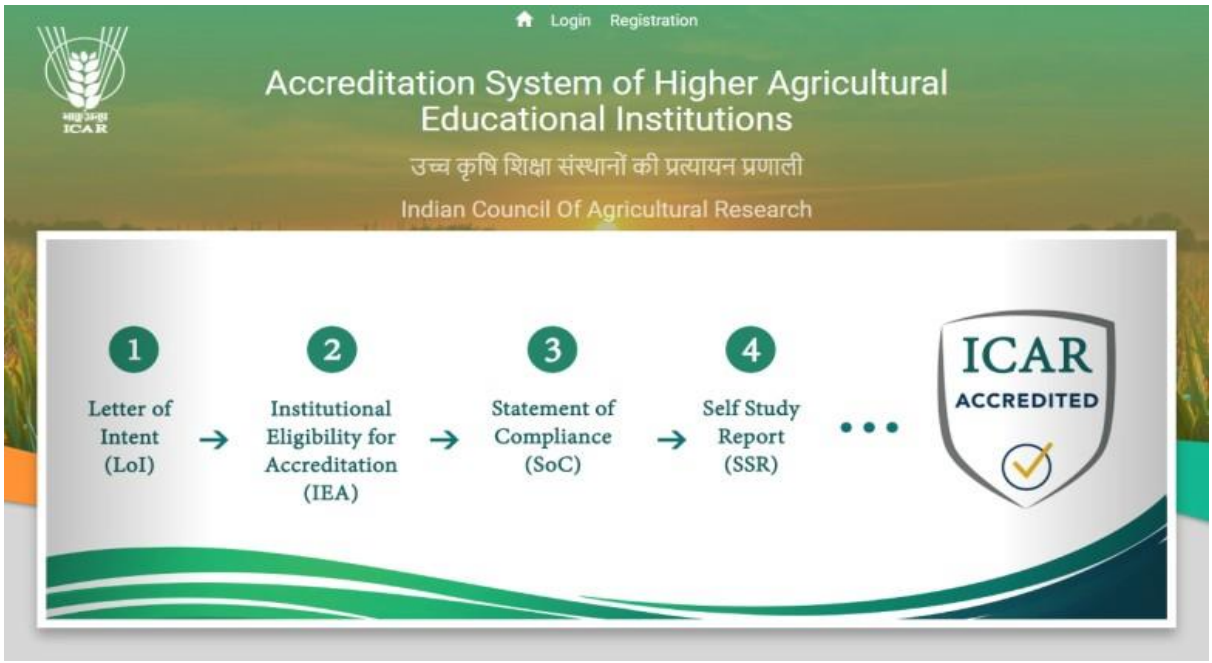
KVC ALUNET has been established with the objective of facilitating alumni from 74 Agricultural Universities onto a common platform. Furthermore, this platform will help current students' network with alumni for internships and placements. Finally, the platform will allow alumni to explore various on-going research activities and collaborate with faculty and students. KVC ALUNET has the potential to strengthen the network of agri-practitioners, researchers and students through the positive power of digital technology. It can promote greater access to resources and increase equity especially with respect to student employment. The platform can be access on http://alumni.icar.gov.in.



Accreditation Portal for Higher Agriculture Education Institutions (HAEI)

A national platform for accreditation of HAEIs has been developed by ICAR-IASRI under NAHEP-component-2 to allow HAEIs apply for ICAR accreditation online. This portal will allow both government and private HAEIs to apply for accreditation online. This is an important development in agricultural education provisioning in the country. The portal will facilitate improvements in quality education by enabling universities and colleges to comply with specific norms and regulations, prescribed by ICAR. Moreover, the portal itself will ensure smoother transactions during the process of accreditation, in turn fostering time efficiency, transparency and greater accountability.

Any HAEI wanting to become accredited by ICAR will have to first submit a Letter of Intent (LOI) along with Institutional Eligibility for Accreditation (IEA) and Statement of Compliance (SoC) to the National Agricultural Education Accreditation Board (NAEAB) Secretariat. Next,



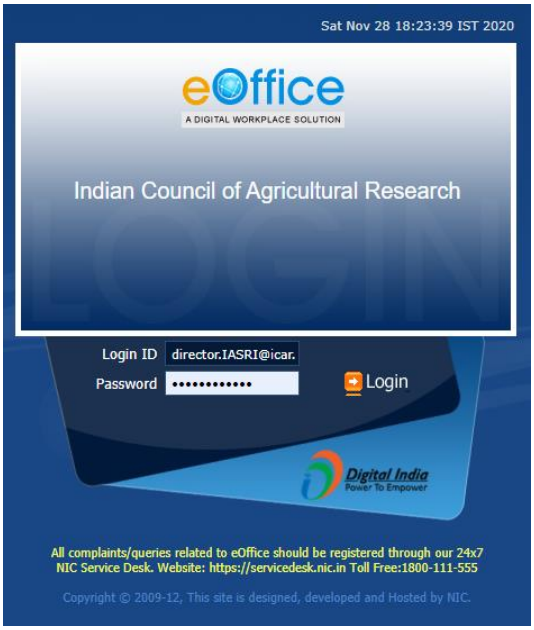
once these documents are accepted, the HAEI will be requested to submit a Self-Study Report (SSR) to the respective Regional Centre of NAEAB through the portal. Regional Centres will examine SSR to determine compliance with NAEAB guidelines. Upon receiving a satisfactory assessment by the Regional Centre, the HAEI will be accredited by ICAR. The portal can be accessed at: https://education.icar.gov.in/Accreditation/

Online Agriculture University Ranking System

In line with the National Initiative on Ranking of Indian Institutions, ranking of Agricultural Universities has been initiated by ICAR with a larger objective to drive the universities towards improving quality standards and enhance their visibility to enable them for participation in global rankings. The ranking status allows the students to make informed choices for university placement. Further, the ranking process is expected to help the universities to self-assess themselves on the quality and enhance their abilities. It also tends to improve healthy competition among universities.

So far, the ranking has been done for the last three years based on the information received from the universities in the prescribed Performa through hard copies. In view of the COVID-19 pandemic situation, it has been decided to obtain the required information from the universities through online. Accordingly, an **"Agricultural University Ranking System (AURS)**" has been developed by ICAR-IASRI, New Delhi to enable the submission of the required data by the universities and the evaluation/verification by the Committee through online. Further, the uploaded information shall be made available in the public domain for bringing transparency to the entire ranking process. AURS can be accessed at https://education.icar.gov.in/auranking/.

E-Office Implementation at ICAR Institutes

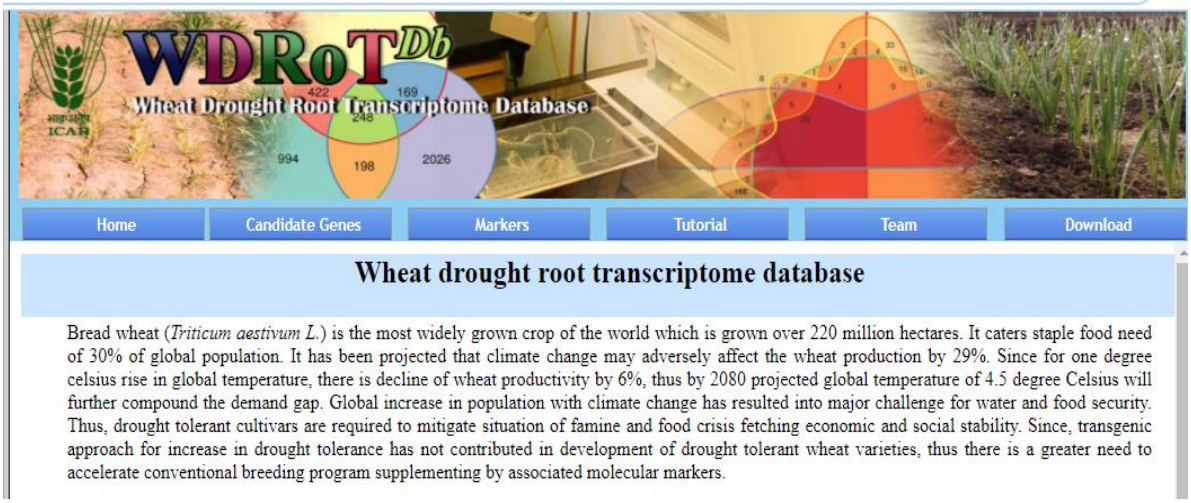


E-Office, an online solution to increase the efficiency and transparency of day to day working has been implemented at all ICAR institutes. The e-Office system has been hosted at ICAR Data Center, ICAR-IASRI as a single instance for all 113 institutes.

The single instance facilitates seamless movement of files between ICAR Hq. and all ICAR institutes as well as among ICAR institute. Trainings in online and offline mode were imparted to all ICAR institutes for the development of Employee Master Data as well as for File Management modules. Nodal Officers were nominated by each institute to implement the e-Office in their institutes. A help desk team at ICAR-IASRI has been established that supports the overall implementation of e-Office and takes care of server side and security issues. The e-Office has contributed significantly during the COVID-19 pandemic situation especially during the lockdown phase, as it allowed all the employees to work from their home and as a result work could be done in time.

Wheat drought root transcriptome database (WDRoTDb)

Computational approach for genomic resource improvement and precision phenotyping of less explored yield traits in wheat has been attempted. Two contrasting genotypes, namely, NI5439 41 (drought tolerant) and WL711 (drought susceptible) were used to generate ~78.2 GB data for the responses of wheat roots to drought. For effective future use of findings, web genomic resource, **Wheat drought root transcriptome database (WDRoTDb)** has been developed (http://webtom.cabgrid.res.in/wdrotdb/). WDRoTDb will serve as valuable resources for new genes discovery as well as developing SSR markers.



Metagenomic profiling for assessing microbial biodiversity in prominent river Ganga waters:

Nine sediment metagenome samples in the context of polluted versus non-polluted sites of river Ganga and Yamuna were analysed using NGS technique. The functional metagenomics analysis revealed the presence of Heavy metal-associated domain (HMA) and HMA-conserved sites in the identified bacteria. Several protein domains including urea ABC transporter, UrtA, UrtD, UrtE and zinc/ cadmium/ mercury/ lead-transporting ATPase, which play pivotal role in bioremediation were identified from the identified bacteria of the riverine polluted environments.

Bioinformatics Web-server/Web-tools/Database/tools developed:

FMDISC (http://bioinformatics.iasri.res.in/fmdisc/team.php) Developed a database which is an information system on Foot and Mouth disease of cattle.

WBMSTDb (http://webtom.cabgrid.res.in/wbmstdb/) Developed Water Buffalo Mastitis Database. This web resource catalogues the information of mastitis associated genes, their annotation, functions, pathways, SNPs and INDELS in buffalo.

ASRpro (https://github.com/meher861982/ASRpro) A supervised learning based methodology named **ASRpro** for multi-label prediction of abiotic stress responsive proteins has been developed.

GIpred (http://cabgrid.res.in:8080/gipred/) A machine learning-based method for prediction of GIGANTEA proteins has been developed. Based on the proposed model, the web server "**GIpred** " has been established.

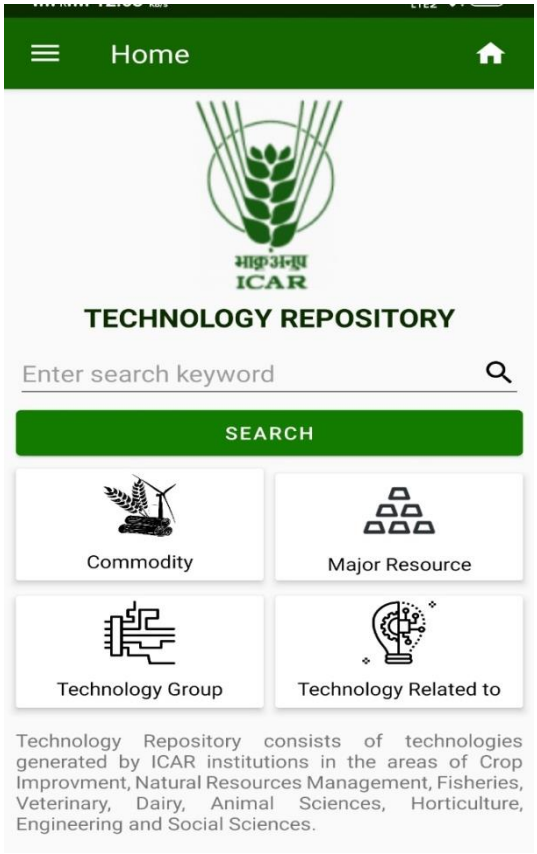
Mobile App developed:

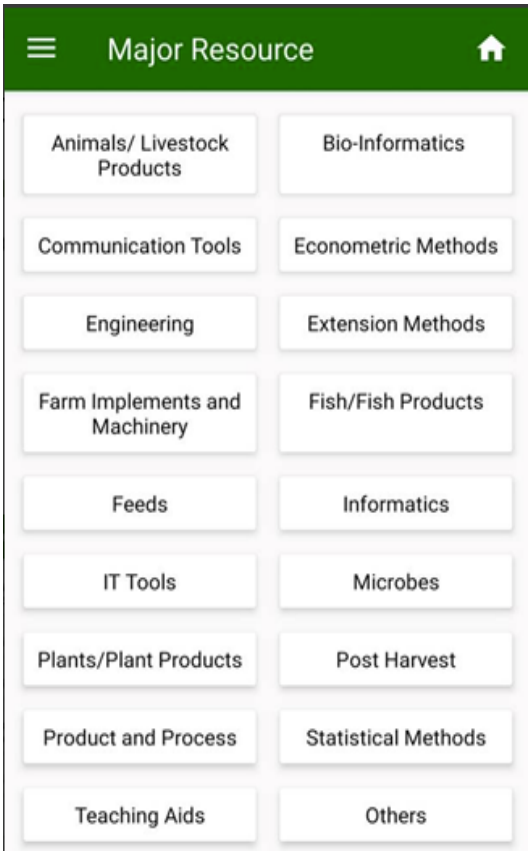
IVRI-Zoonoses-App: This app aims at providing basic information about important zoonotic infections including their modes of transmission, symptoms, prevention and control measures. The list of national disease control programmes w.r.t. zoonotic diseases has also been included along with the list of notifiable diseases in animals. This App will be useful to students of veterinary and medical degree programmes, practicing veterinarians, health care workers and general public.

IVRI-Veterinary Clinical Care-App: This app targets to impart knowledge and skills to Graduating Veterinarians & Field veterinary Officers about most frequent clinical conditions encountered in field conditions related to medicine, gynecology & surgery. The App covers information about each of these conditions under the various subheads viz., About, Symptoms, Diagnosis, Treatment and Prevention & Control.

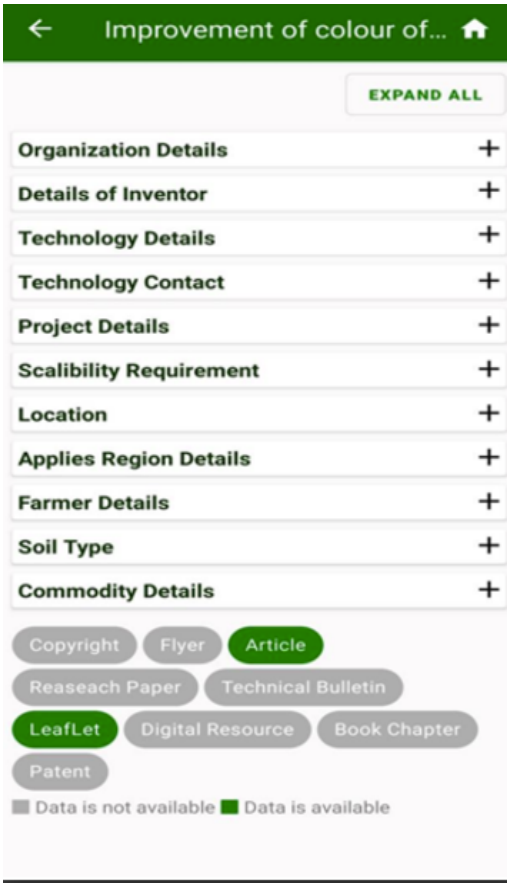
Mobile App for ICAR-Technologies

Technology Mobile App developed based on the Technology Repository which consists of proven technologies/methodologies generated by ICAR institutions. The mobile app provides the information on the selection on commodity, major resource, technology group and technology related particular field. It also provides search facility based on key word. More than 1270 technologies are available in open access. Using web services, the information on ICAR Technologies is also made available on Open Government Data Platform. It has 5000+downloads.


Home
ICAR
TECHNOLOGY REPOSITORY
Enter search keyword
SEARCH
Commodity
Major Resource
Technology Group
Technology Related to
Technology Repository consists of technologies generated by ICAR institutions in the areas of Crop Improvment, Natural Resources Management, Fisheries, Veterinary, Dairy, Animal Sciences, Horticulture, Engineering and Social Sciences.


Major Resource
Animals/ Livestock Products
Bio-Informatics
Communication Tools
Econometric Methods
Engineering
Extension Methods
Farm Implements and Machinery
Fish/Fish Products
Feeds
Informatics
IT Tools
Microbes
Plants/Plant Products
Post Harvest
Product and Process
Statistical Methods
Teaching Aids
Others


Search: Fish/Fish Pr...
No of Record:46
1 - Technology Name: Improvement of colour of Indian Pangasius Fillets
Subject Matter Division: Fisheries Science
Organization Name: ICAR-Central Institute of Fisheries Technology,Cochin
Know more ...
2 - Technology Name: Tropomyosin subjected to longer period of boiling for shrimp allergy diagnosis
Subject Matter Division: Fisheries Science
Organization Name: ICAR-Central Institute of Fisheries Technology,Cochin
Know more ...
3 - Technology Name: Removal of Cadmium and Lead from water using different grades of chitosan
Subject Matter Division: Fisheries Science
Organization Name: ICAR-Central Institute of Fisheries Technology,Cochin
Know more ...
4 - Technology Name: SYNTHESIS OF CARBON DOTS FROM CHITOSAN
Subject Matter Division: Fisheries Science


Improvement of colour of...
EXPAND ALL
Organization Details
Details of Inventor
Technology Details
Technology Contact
Project Details
Scalibility Requirement
Location
Applies Region Details
Farmer Details
Soil Type
Commodity Details
Copyright
Flyer
Article
Reaseach Paper
Technical Bulletin
LeafLet
Digital Resource
Book Chapter
Patent
Data is not available
Data is available

OGS: Outlier in Genomics Data

Description: Detection of influential observation is one of the crucial step of pre-processing to identify suspicious elements in data that may be due to error or some other unknown source. Several statistical measures are already developed for detection of influential observation but still there is a challenge to detect a true influential observation for high dimension data like gene expression, genotyping data. This package identifies influential observation by implementing meta-analysis based approach to combining various least absolute shrinkage and selection operator (LASSO) based diagnostic (Rajaratnam (2019) doi:10.1080/10618600.2019.1598869) in genomic data hence named as OGS (i.e. outlier in genomic data) based on their p-value. This package identifies outlier in genomic data using different p-value combination methods (i.e. inverse chi, logit, meanp, meanz, sumz, sumlog, sump) with suitable p-value cutoff.

Effective Drought Index (EDI)

Description: The effective drought index (EDI) is considered superior to several drought indices for drought assessment due to its ability to detect the initiation and termination of drought. In general, EDI quantifies drought through the concept of a surplus or deficit of water resources (Byun and Lee, 2002). The package computes the Effective Drought Index (EDI) (Byun and Wilhite, 1999) from a time series daily or monthly precipitation data.

IGST: Informative Gene Selection Tool

Mining informative genes with certain biological meanings are important for clinical diagnosis of disease and discovery of disease mechanisms in plants and animals. This process involves identification of relevant genes and removal of redundant genes as much as possible from a whole gene set. This package selects the informative genes related to a specific trait using gene expression dataset. These trait specific genes are considered as informative genes. This package returns the informative gene set from the high dimensional gene expression data using a combination of methods SVM and MRMR (for feature selection) with bootstrapping procedure.

TEnGExA :

RNA-seq data analysis with rapidly advancing high-throughput sequencing technology, nowadays provides large number of transcripts or genes to perform downstream analysis including functional annotation and pathway analysis. However for the data from multiple tissues, downstream analysis with tissue-specific or tissue-enriched transcripts is highly preferable. However, there is still a need of tool for quickly performing tissue-enrichment and gene expression analysis irrespective of number of input genes or tissues at various fragments per kilobase of transcript per million fragments mapped (FPKM) thresholds. To fulfill this need, we presented a freely available R package and web-interface tool, TEnGExA, which allows tissue-enrichment analysis (TEA) for any number of genes or transcripts for any species provided only a read-count or FPKM-value matrix as input. Based on the different FPKM value and fold thresholds, TEnGExA classifies the user provided gene lists into tissue-enriched or tissue-specific transcripts along with other standard classes. By analyzing the published sample data from human, plant and microorganism, we signifies that TEnGExA can easily handle complex or large data from any species to provided tissue-enriched gene list for downstream analysis in quick time. In summary, TEnGExA is quick, easy to use and an efficient tool for TEA. The R package is freely available at **https://github.com/ubagithub/TEnGExA/** and the GUI web interface is accessible at **http://webtom.cabgrid.res.in/tissue_enrich/.**

PredCRG: Computational Prediction of Proteins Encoded by Circadian Genes

A computational model for predicting proteins encoded by circadian genes. The support vector machine has been employed with Laplace kernel for prediction of circadian proteins, where compositional, transitional and physico-chemical features were utilized as numeric features. User can predict for the test dataset using the proposed computational model. Besides, the user can also build their own training model using their training dataset, followed by prediction for the test set.

- Developed a web server "**miRNALoc**" for predicting localization of miRNAs. The server is accessible at **http://cabgrid.res.in:8080/mirnaloc/.**
- Developed a database "**FMDISC**", which is an information system on Foot and Mouth disease of cattle. The database can be accessed at **http://bioinformatics.iasri.res.in/fmdisc/team.php**.
- Developed Water Buffalo Mastitis Database (**WBMSTDb**): This web resource catalogues the information of mastitis associated genes, their annotation, functions, pathways, SNPs and INDELS in buffalo and is available at **http://webtom.cabgrid.res.in/wbmstdb/**
- ICAR-IASRI in association with ICAR-IISR has developed **Black Pepper Drought Transcriptome Database** (BPDRTDb), freely accessible for academic use at http://webtom.cabgrid.res.in/bpdrtdb. This transcriptome characterizations of black pepper genotype and its web resource will serve as valuable resources for new genes discovery as well as developing SSR markers in endeavour of higher crop production. Putative markers can also be a reliable genomic resource to develop drought tolerant variety for better black pepper productivity.

Chapter 4
Technology Assessed and Transferred

- ***WebGRC online software***: (Anindita Datta, Seema Jaggi, Cini Varghese, Eldho Varghese, Arpan Bhowmik and Mohd. Harun) An online software ***Web Generation of Generalized Row-Column Designs (WebGRC)*** has been developed and deployed at http://webgrc.icar.gov.in/. The home page of the software is shown in Fig. 4.1. *Web*GRC generates Generalized Row- Column (GRC) designs (structurally complete and structurally incomplete) given in Fig 4.2. It generates GRC design for odd number of treatments (Datta *et al.*, 2016), GRC designs for even number of treatments (Datta *et al.*, 2016; Parsad, 2006), GRC designs for prime number of treatments (Datta *et al*., 2015) and the screenshot is given in Fig 4.3. It also generates different series of structurally incomplete GRC designs developed by Datta *et al.* (2014) and the corresponding screenshot is given in Fig. 4.4. The webpage displays the layout plans along with the randomized layout for given number of treatments. It also displays various parameters of the generated designs viz. number of treatments, numbers of rows, number of columns and number of unit per cell. The output can be saved by the end user in an MSExcel sheet. To provide an idea about GRC designs a section named 'About Design' has been created in the software which provides the information about GRC designs along with examples.

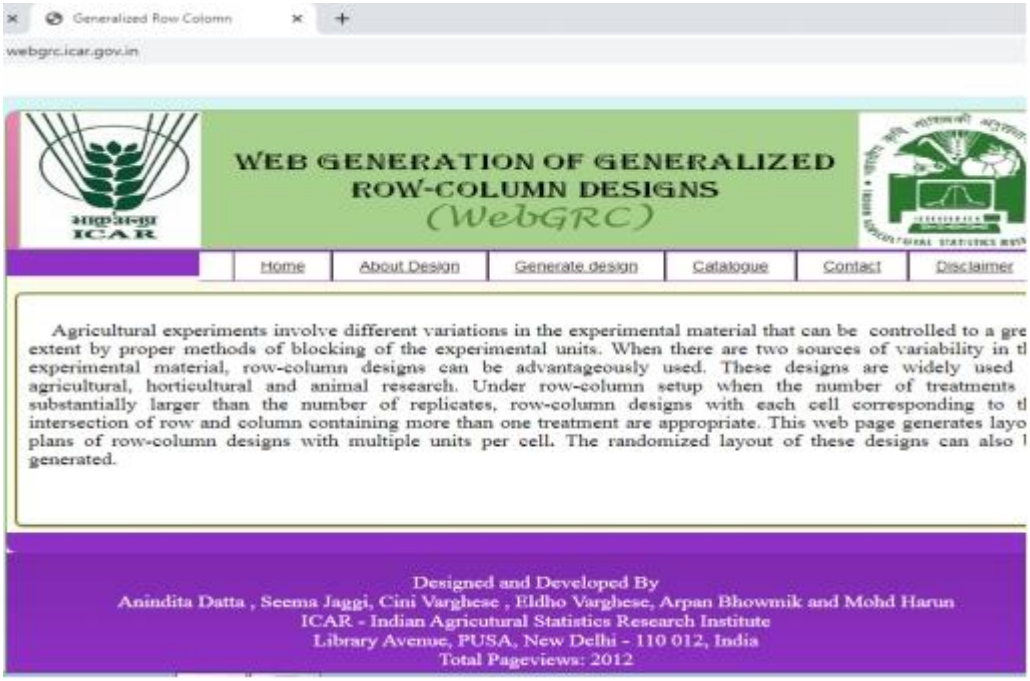


Fig.4.1: Home page of *Web*GRC

Fig. 4.2: Generation of GRC designs through *Web*GRC

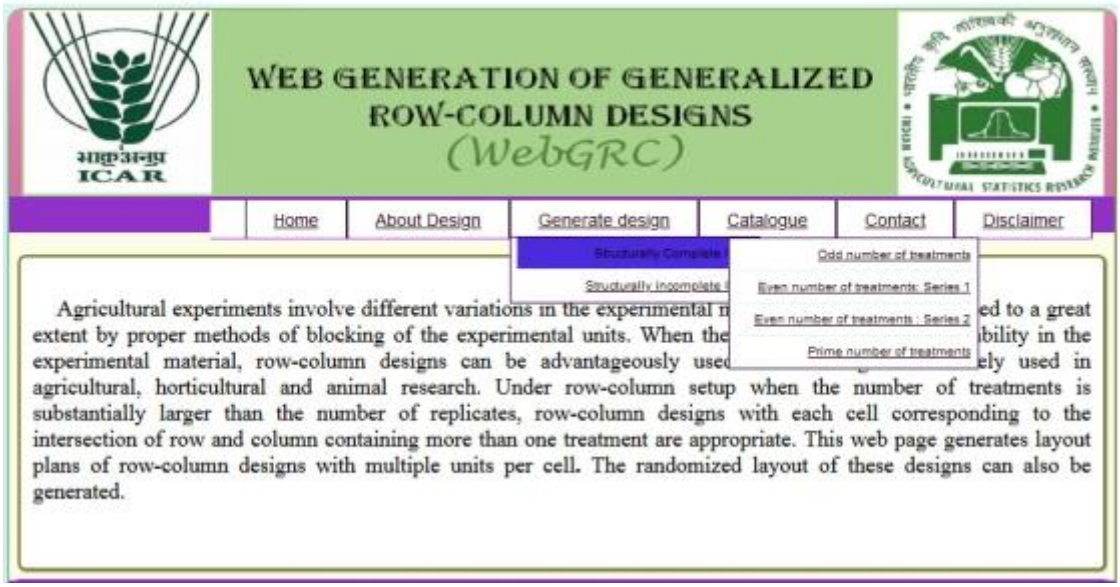


Fig. 4.3: Menu page of structurally complete *Web*GRC

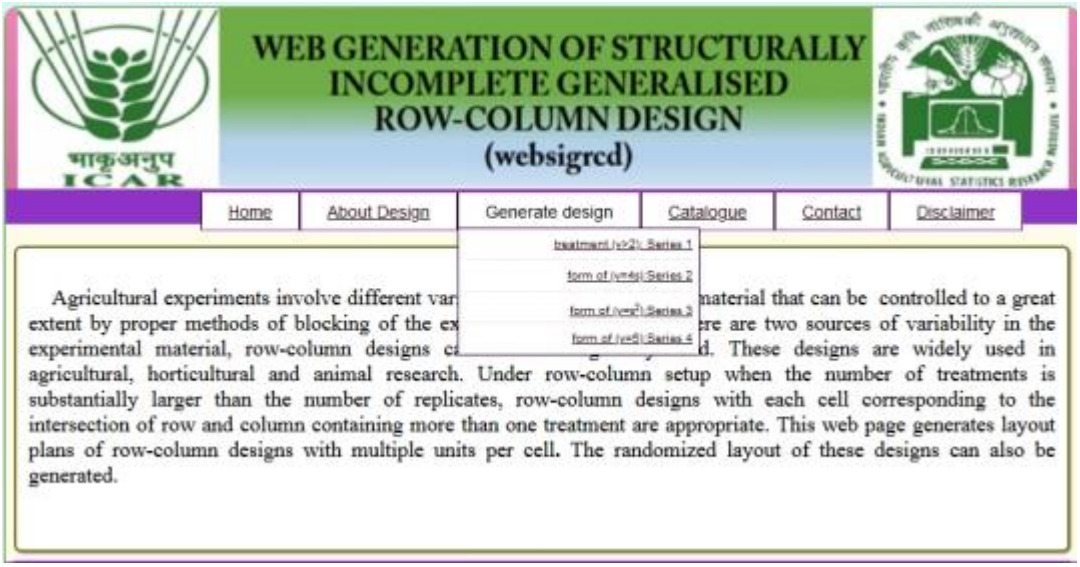


Fig. 4.4: Menu page of structurally incomplete *Web*GRC

- **Online catalogue for different series of GRC designs**: (Anindita Datta, Seema Jaggi, Cini Varghese, Eldho Varghese, Arpan Bhowmik and Mohd. Harun) Online catalogue for different series of GRC designs for a specific set of parametric combinations have also been developed and integrated with WebGRC (http://webgrc.icar.gov.in/). User can also generate designs from these catalogues (Fig. 4.5)

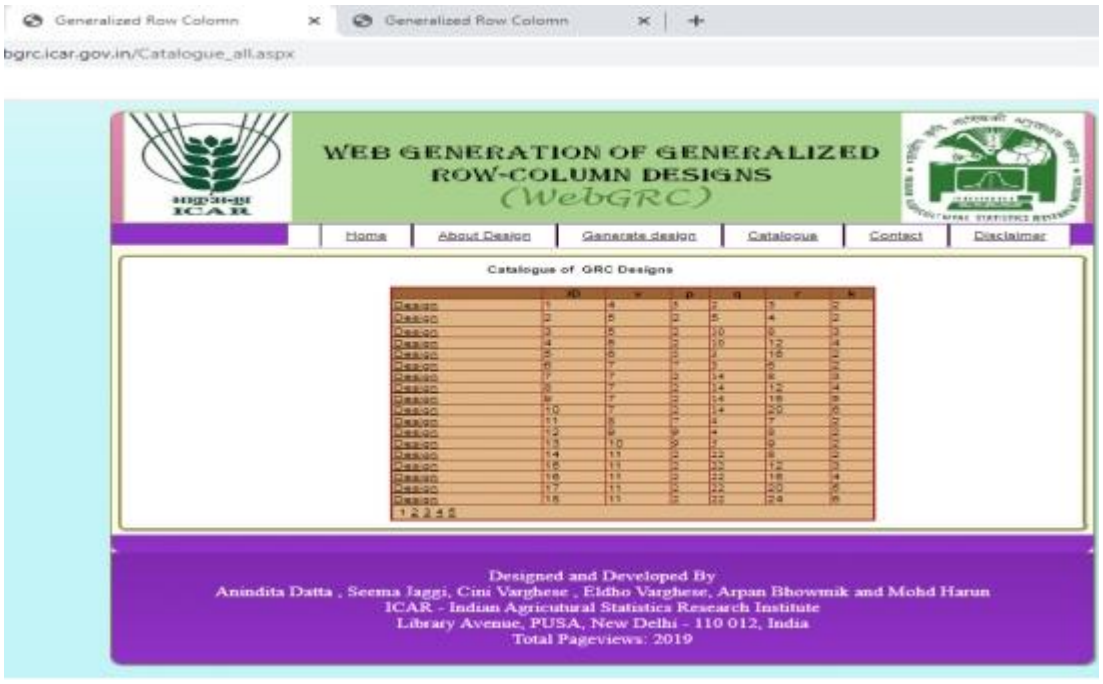


Fig. 4.5: Catalogue of structurally incomplete *Web*GRC

- ***Web application on phytochemical knowledge based system for crop protection***: (Sukanta Dash, Anil Kumar, ICAR-IARI, New Delhi - Anupama Singh, Aditi Kundu, Anirban Dutta, Abhishek Mandal, Neeraj Patanjali, Supradip Saha, Rajesh Kumar, V. Shanmugam, Ramesh K Yadav, Bhagyashri S, MR Khan, R Roy Burman) A web application named as "Web enabled phytochemical knowledge based system for crop protection" have been developed and deployed at IASRI server with URL http://naeagchem.icar.gov.in

A total of 2589 records have been entered in the developed application. Different modules like About, Help, Contact, Achievements, Important links have been updated in the application. Provided Open access authentication to Query functionality i.e. now guest user can also access query tab.

- ***Online data submission and analysis module for on-station research experiments under AICRP on IFS***: (Sukanta Dash, Anil Kumar, Susheel Kumar Sarkar, Mohd. Harun) An online data submission and analysis module for on-station research experiments under AICRP on IFS has been developed as a lead developer and deployed at the IASRI server with URL http://aicrponstation.icar.gov.in.

- ***R-package PredCRG***: (P.K. Meher, 2020) Prediction of circadian proteins encoded by circadian genes available at https://cran.r-project.org/web/packages/PredCRG/index.html.
- ***Web server GIpred***: (P.K. Meher, 2020) Prediction of GIGANTEA proteins freely accessible at http://cabgrid.res.in:8080/gipred/.
- ***Web server miRNALoc***: (P.K. Meher, 2020) Predicting localization of miRNAs freely accessible at http://cabgrid.res.in:8080/mirnaloc/.
- ***Database FMDISC***: (P.K. Meher, 2020) Information system on Foot and Mouth disease of cattle freely available at http://bioinformatics.iasri.res.in/fmdisc/team.php.

- ***Method/ Algorithm developed***: (Samarendra Das, 2020) Improved Bootstrap-SVM-MRMR method for Selection of Biological Relevant Genes from High-dimensional Gene Expression Data
- ***Method/ Algorithm developed***: (Samarendra Das, 2020) Novel Statistical Approach developed for performing Gene Set analysis with Quantitative Trait Loci (QTL) for Microarrays Gene Expression Studies
- ***Method/ Algorithm developed***: (Samarendra Das, 2020) Statistical Method developed for single-cell RNA-sequencing data analytics
- ***Method/ Algorithm developed***: (Samarendra Das, 2020) Statistical Approach developed for Gene Set Analysis with QTL for RNA-sequencing Gene Expression studies

- ***R package BSM***: (Samarendra Das, 2020) Selection of Biologically Relevant Genes from High-dimensional Gene Expression Data freely available at https://github.com/sam-uofl/BSM
- ***R package SwarnSeq***: (Samarendra Das, 2020) Analysis of Single cell RNA-sequencing data freely available at https://github.com/sam-uofl/SwarnSeq
- ***R package GSQSeq***: (Samarendra Das, 2020) Gene Set Analysis with QTL for RNA-sequencing gene expression studies freely available at https://github.com/sam-uofl/GSQSeq

- ***R package MSGARCHelm***: (Rajeev Ranjan Kumar, Girish Kumar Jha, and Neeraj Budhlakoti, 2020) Hybridization of MS-GARCH and ELM Model. https://cran.rproject.org/web/packages/MSGARCHelm/index.html
- ***R package SBAGM***: (Rajeev Ranjan Kumar, Girish Kumar Jha, Dwijesh C. Mishra, 2020) Search Best ARIMA, GARCH, and MS-GARCH Model. https://cran.r-project.org/web/packages/SBAGM/index.html
- ***GitHub repository EDI***: (Rajeev Ranjan Kumar, K.N Singh, D.C. Mishra and Neeraj Budhlakoti, 2020) Calculation of Effective Drought Index. URL: https://github.com/rrk4910/EDI .

- ***R package EEMDelm***: (Girish Kumar Jha, Kapil Choudhary, Rajeev Ranjan Kumar and Ronit Jaiswal, 2020) Ensemble Empirical Mode Decomposition and Its Variant Based ELM Model. https://cran.r-project.org/web/packages/EEMDelm/index.html
- ***R package BayesARIMAX*** : (Achal Lama, K.N. Singh, and Bishal Gurung, 2020) Bayesian estimation of ARIMAXmodel (https://CRAN.Rproject.org/package=BayesARIMAX) http://krishi.icar.gov.in/jspui/handle/123456789/44702
- ***Method/ Algorithm developed***: (Ravindra Singh Shekhawat, 2020) Standard methodology for analyzing the impact of tractorization using household level data with the application of panel tobit model.
- ***Method/ Algorithm developed***: (Ravindra Singh Shekhawat, 2020) Implementation of panel regression model for estimating the impact of tractorization on farm productivity in terms of rupees per acre.
- ***Method/ Algorithm developed***: (Ravindra Singh Shekhawat, 2020) Implementation of standardized methodology of panel regression model for estimating the impact of tractorization on intensification of agriculture.

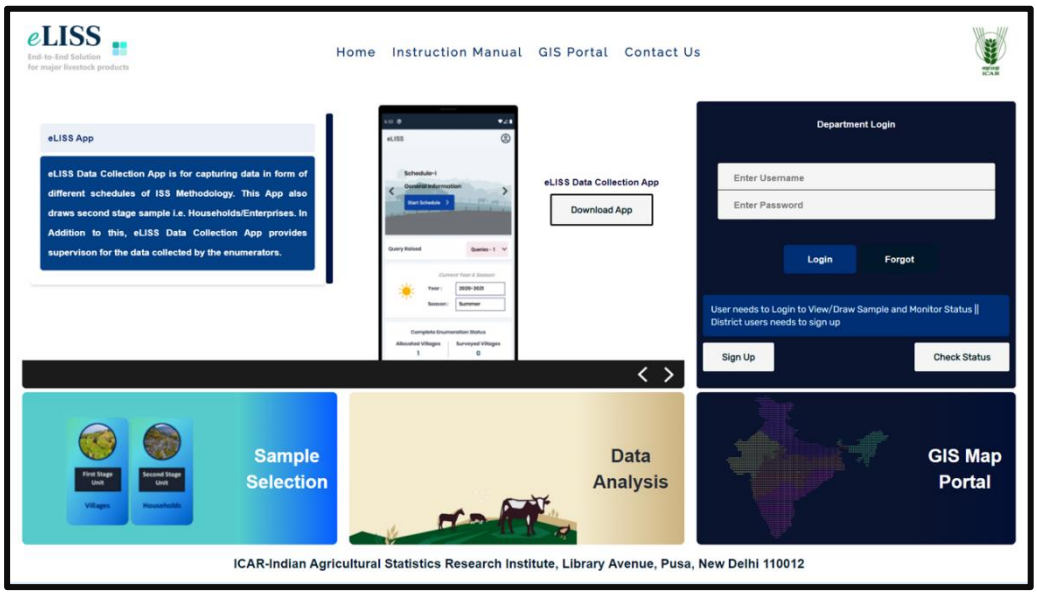
- ***eLISS Web Portal and eLISS data collection App*: (**Prachi Misra Sahoo, Tauqueer Ahmad, Anil Rai, Ankur Biswas and Raju Kumar**)** A web portal eLISS was developed which provides end-end solution of major livestock commodities. The estimates of number of animals and production of all four commodities Milk, Meat, Egg and Wool can be obtained at District, State/UT and National level. The final estimates generated through the portal can be viewed and downloaded by the users and the Ministry in different formats. The portal is running live on https://iss.icar.gov.in.

  This portal consists of three modules i) Sample Selection Module ii) Data Entry and Analysis Module iii) GIS Map Module. Sample Selection Module allows states to draw sample for complete enumeration and detailed survey for all three seasons (summer, rainy and winter) in a year according to the ISS methodology. One of the most important function of this portal is sample selection of first stage units i.e. villages/urban wards in each district. The selected sample of villages/urban wards can be downloaded by all the districts in each State/UT. This sample is used for data collection in all the three seasons. For data collection from the field, an android based application is developed which has replaced manual paper-based data collection. All the eight schedules of ISS scheme have been designed in the data collection application with all the fields and entries. The data captured through this app will be synced to server by the user. The data collected by the user can be supervised at higher levels i.e., Districts and States. This data collection app also selects second stage sample i.e. households/enterprises by using the list of households/enterprises captured in schedule-II as sampling frame.

  For implementation of web portal and eLISS data collection app., training was imparted to all the States/UTs and Districts of the country.

eLISS web portal developed under the project is being used all over India since its launch in January 2020. All States/UTs are registered on the portal and currently 662 Districts are active. Around 12,833 Enumerators and 4,679 Supervisors have registered on the portal. First Stage Sample for complete enumeration and detailed survey i.e. Villages/Urban wards for all the districts in all States/UTs have been drawn via eLISS Web Portal for 2020-2021 and 2021-2022. Sample selected by State/UT officials have been allocated among enumerators by their districts using the eLISS web portal allocation module. Implementation support is being provided to all the States/UTs through call, emails and WhatsApp groups on regular basis at all stages including field survey.

Around 57,864 district level records for all animal groups pertaining to Milk, Meat, Egg and Wool have been captured using the portal for the year 2019-2020 and 2020-2021. Further, by using these records, State/UT level estimates of number of animals and production of livestock commodities (Milk, Meat, Egg and Wool) are obtained. Real time status of survey can be monitored at State/UT and District level using this eLISS data collection app. and web portal. This web portal and data collection app will provide end-to-end solution for estimating number of animals and production of Milk, Meat, Egg and Wool season-wise every year on regular basis.



- The ***Improvement of Agricultural Statistics (IAS) Scheme*** of Directorate of Economics & Statistics (DES), Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW), Ministry of Agriculture and Farmers Welfare, Govt. of India, which is operational in 25 States was evaluated for its effectiveness and usefulness under the project 'Evaluation of Improvement of Agricultural Statistics Scheme'. The objectives, methodology including sampling design and estimation procedure, data quality, manpower structure under the scheme were critically evaluated at different levels. The questionnaires were designed for data collection from all the 25 States out of which primary data collection was done in five states of Uttar Pradesh, Haryana, Karnataka and Rajasthan and Orissa.
- Technical guidance for ***implementation of methodology developed*** for estimation of area and production of horticultural crops by ICAR-IASRI ***under CHAMAN program*** was provided to Haryana State Government for obtaining State and district level estimates of area and production of various fruits and vegetables for 2019-20 and 2020-21 under the project entitled 'Technical Guidance in Implementation of Methodology for Estimation of Area and Production of Horticultural Crops developed by ICAR-IASRI under CHAMAN Project'. Online training was imparted to the State Government officials and FIs on "Use of data entry software provided by ICAR-IASRI" and "Filling up of schedules/questionnaires and sample selection".
- The ***Comprehensive Scheme for studying Cost of Cultivation of Principal Crops*** which is operational in 19 States was evaluated for its effectiveness and usefulness under the project 'Evaluation of Comprehensive Scheme for studying Cost of Cultivation of Principal Crops'. The objectives, methodology including sampling design and estimation procedure, data quality, manpower structure under the scheme were critically evaluated at different

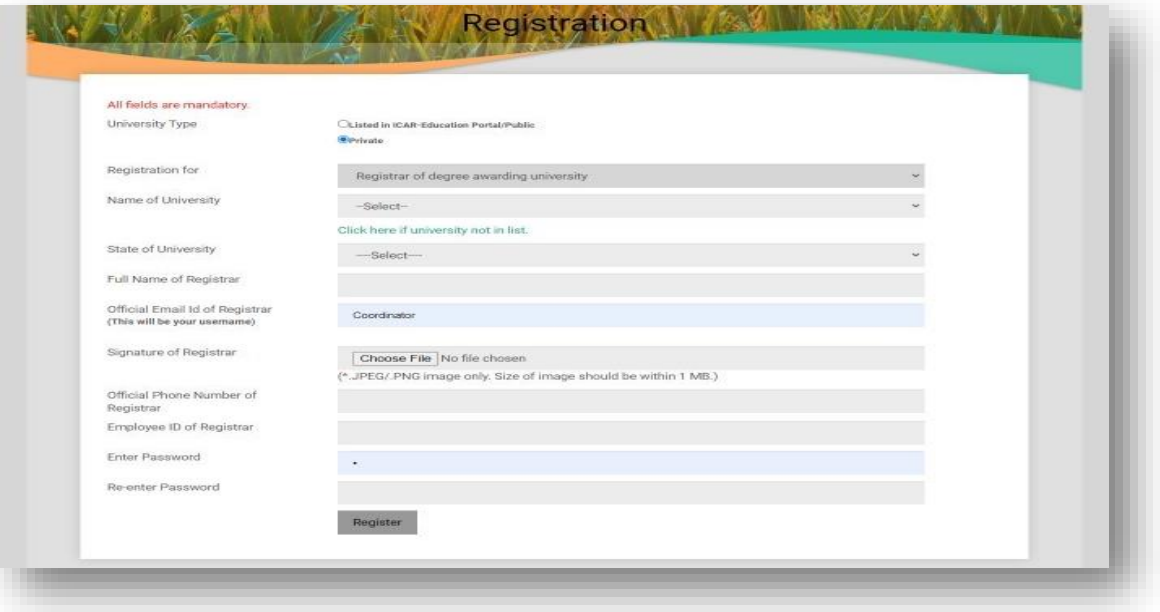
levels. The questionnaires were designed for data collection from all the 25 States out of which primary data collection was done in five states of Uttar Pradesh, Haryana, Karnataka and Rajasthan and Orissa.

- The ***Agriculture Census Scheme*** which is operational in all the States was evaluated for its effectiveness and usefulness under the project 'Evaluation of Agriculture Census Scheme'.

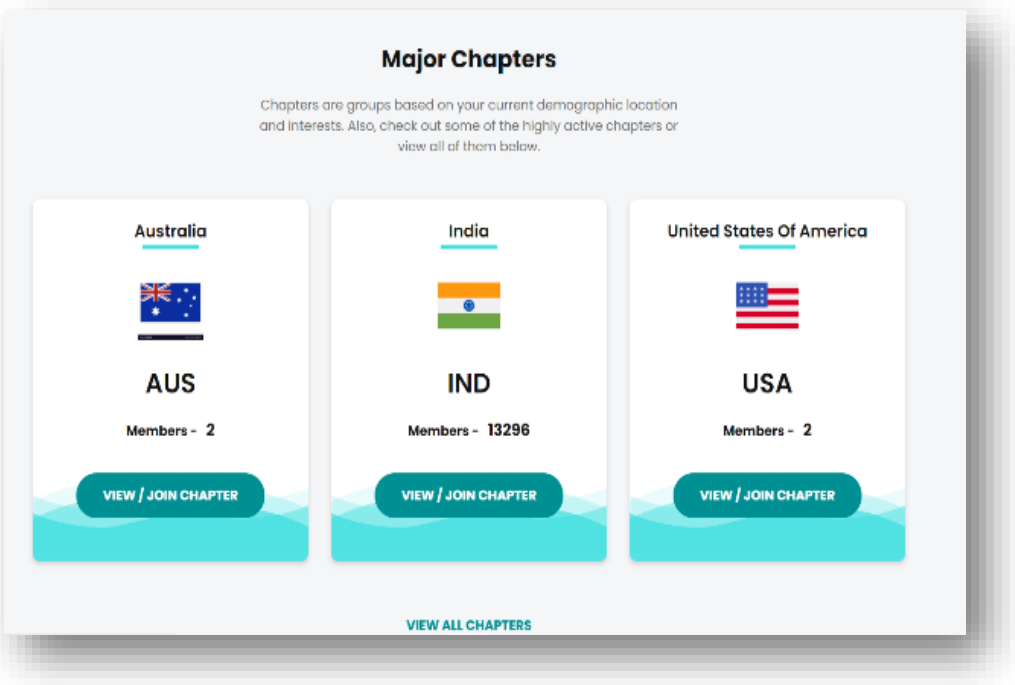
- ***KRISHI MEGH*****: (**Sudeep Marwaha, Alka Arora, Ramasubramanian, V., Anshu Bharadwaj, Mukesh kumar, Shashi Dahiya, Pal Singh, S.N. Islam, Soumen Pal, A.K. Choubey, ICAR HQ, New Delhi - K.P. Singh, ICAR-IARI, New Delhi - A.K. Mishra; Subhash Chand, Virender Kumar and Sunil Bhatia) KRISHI MEGH is the integration of the ICAR data Centre (DC) at ICAR-IASRI with the Disaster Recovery Centre (DRC) at the ICAR-NAARM, Hyderabad. The primary objective is to provide a robust and dynamic IT infrastructure to meet the growing IT needs of the NARES system. Data Center has been developed under project "Investment in ICAR Leadership for Agriculture Higher Education" under National Agricultural Higher Education Project 'Component 2'.

The major beneficiary is National Agricultural Research and Education System (NARES). ICAR Data Centre has facility with following specifications: 960 Cores, 6224 GB RAM, 400 TB Storage and Cloud Disaster Recovery has facility with following specifications: Smart Rack 804 Crores 2940 RAM, 225 TB Storage.

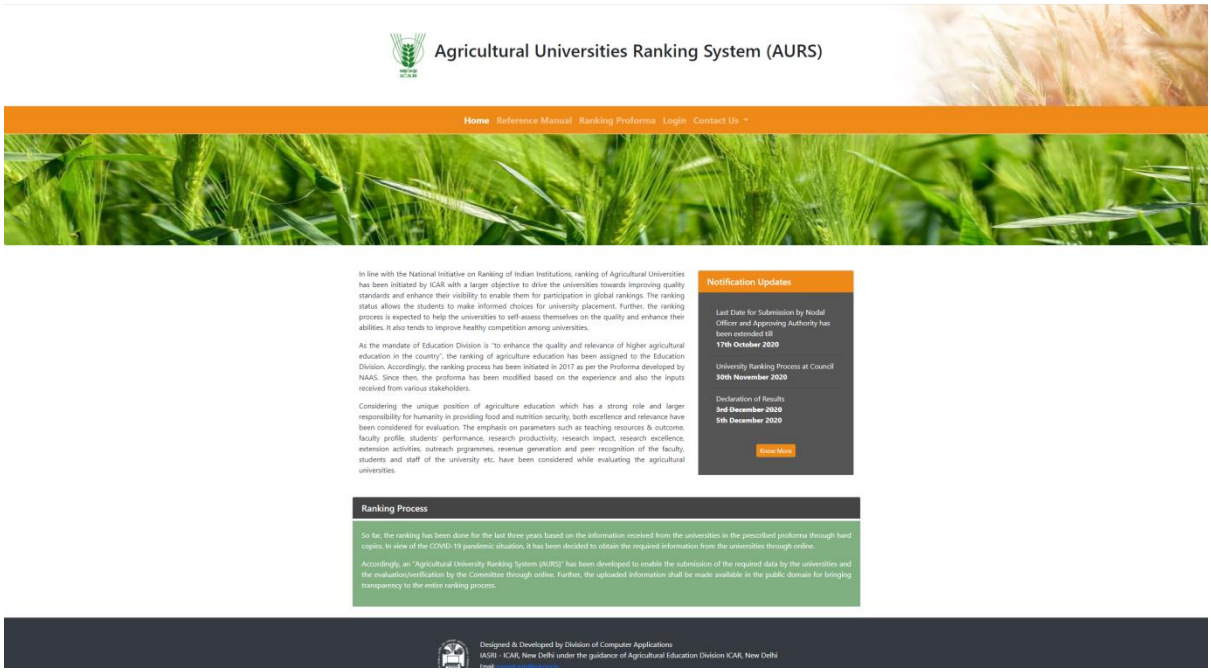
- ***Accreditation Portal*: (Sudeep Marwaha, Alka Arora, Anshu Bharadwaj and Soumen Pal)** This has been developed under project "Investment in ICAR Leadership for Agriculture Higher Education" under National Agricultural Higher Education Project 'Component 2'. This Portal allows both Government and Private Agriculture Universities/Colleges (HAEI) to apply for online accreditation by submitting relevant documents to National Agriculture Education Accreditation Board (NAEAB) Secretariat for approval. The ICAR accreditation improves the quality and relevance of higher education in agriculture universities through effective regulation and peer review processes. It is available at - https://accreditation.icar.gov.in. The beneficiaries are the Higher Agricultural Educational Institutions seeking ICAR accreditation.



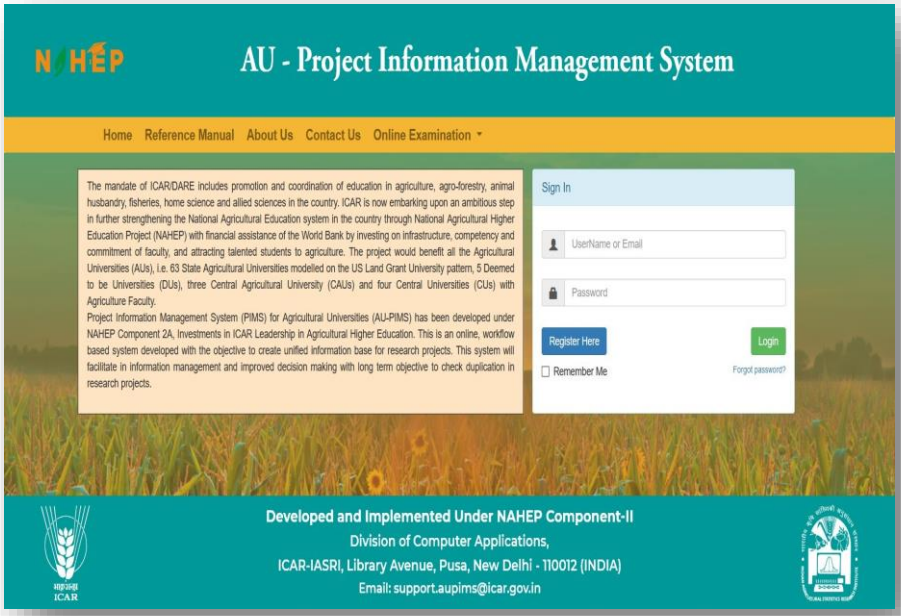
- ***KVC-ALNET*:** (Sudeep Marwaha, Anshu Bharadwaj and Soumen Pal). This facility has been developed under project "Investment in ICAR Leadership for Agriculture Higher Education" under National Agricultural Higher Education Project 'Component 2'**.** It allows all the ex-students and present students to connect and collaborate on an exclusive online platform developed to facilitate strategic networking among agriculture professionals to stay in touch with their fellow alumnus specialized in multiple fields of work across all agriculture universities and colleges. It is available at URL - https://alumni.icar.gov.in. The beneficiaries are all stakeholders of agricultural education eco-system in India. So far, more than 22,000 alumna are registered on this platform.



- ***Agriculture University Ranking System (AURS)***: (Alka Arora and Sudeep Marwaha) This facility has been developed under project "National Information System on Agricultural Education Network in India (NISAGENET-IV)". System has been developed under the guidance of Education Division, ICAR, in line with the National Initiative on Ranking of Indian Institutions. Ranking of Agricultural Universities has been initiated by ICAR with a larger objective to drive the universities towards improving quality standards and enhance their visibility to enable them for participation in global rankings. It is available on URL https://education.icar.gov.in/auranking/. The beneficiaries are all Agricultural Universities across India. It is emphasized here that ranking of Agricultural Universities for the year 2019 was done online through this system.

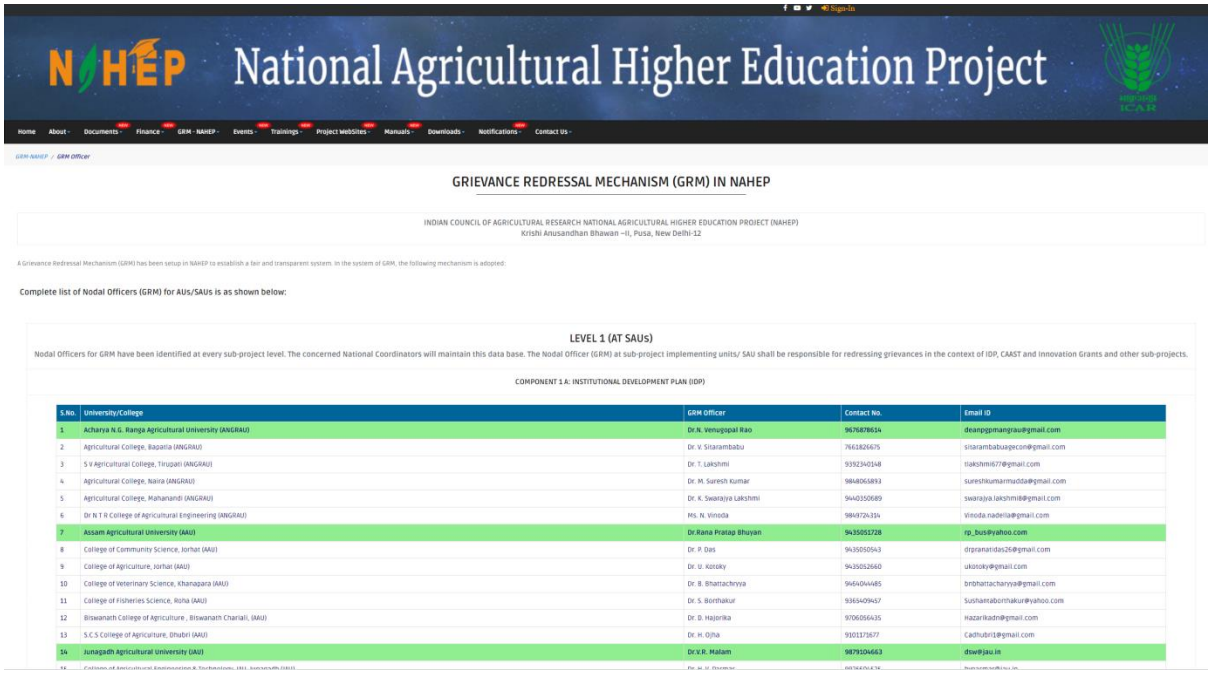


- ***Agriculture University- Project Information Management System (AU-PIMS)***: (Sudeep Marwaha , Alka Arora, Anshu Bharadwaj, Mukesh Kumar, Ajit Kumar, Soumen Pal) This facility has been developed under project " Investment in ICAR Leadership for Agriculture Higher Education" under National Agricultural Higher Education Project Component 2. AU-PIMS has in-built workflows for effective information management related to research projects. System enables creation of research projects repository for universities as well as at the national level. System has provision for document management related to projects. It is available on https://education.icar.gov.in/aupmis/index/aspx. The beneficiaries are all Agricultural Universities across India.

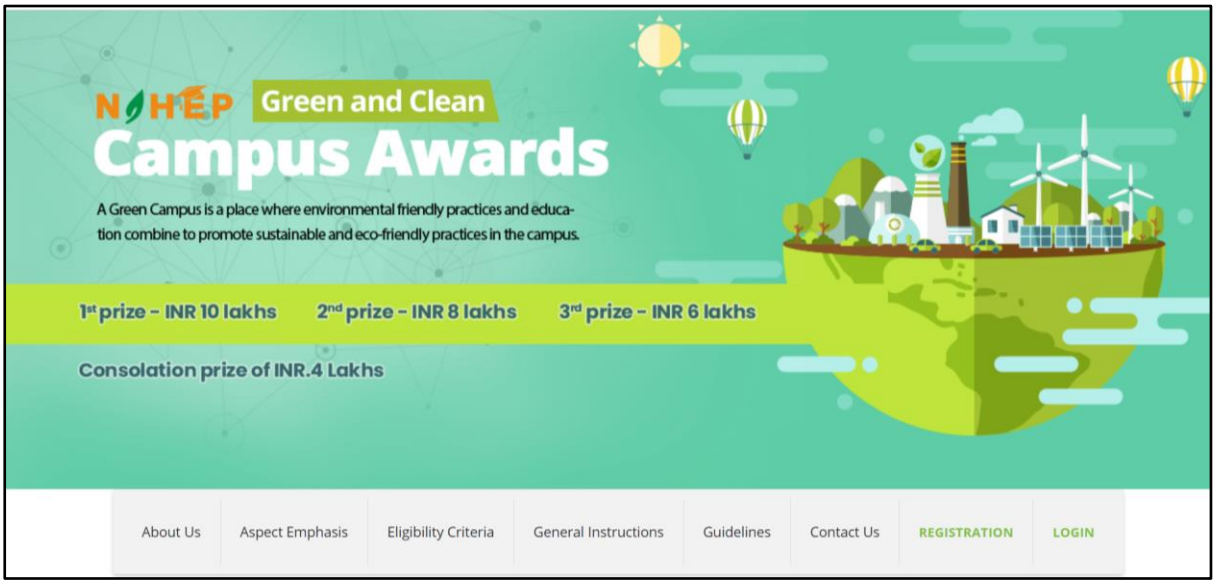


- ***E-Learning Portal***: (Sudeep Marwaha, Anshu Bharadwaj, Shashi Dahiya and Soumen Pal) This portal has been developed under project Investment in ICAR Leadership for Agriculture Higher Education" under National Agricultural Higher Education Project 'Component 2'. E-Learning portal is developed with an objective to strengthen the Agriculture Higher Education in India by developing and disseminating the e-courses for undergraduate and postgraduate Agriculture Courses. The portal allows agriculture higher education faculty to develop and revise digital learning content for undergraduate, post graduate and Ph.D. courses. It is available on https://education.icar.gov.in/eLearningHomePage.aspx. The beneficiaries are students and Faculty of Agricultural Universities. Some of the key statistics are: Registered Users – 2513; Content Creators – 387; Unit Reviewer – 122; Course Reviewer – 125

- ***NAHEP- Grievance Redressal Mechanism System (GRMS)***: (Sudeep Marwaha, Alka Arora, Anshu Bharadwaj, Shashi Dahiya, Soumen Pal, Pal Singh) This facility has been developed under project Investment in ICAR Leadership for Agriculture Higher Education" under National Agricultural Higher Education Project 'Component 2'. The Grievance Redressal Mechanism System is developed with an objective to have fair and transparent system for NAHEP participating agricultural universities to report grievance with respect to procurement, social, environmental and other issues. This system encourages, stakeholders to raise concerns without fear of reprisal and provide a fair and speedy means of dealing with complaints and prevents minor disagreements developing into more serious disputes. It is available on https://nahep.icar.gov.in/creatgrm.aspx. The beneficiaries are NAHEP Participating Agricultural Universities.



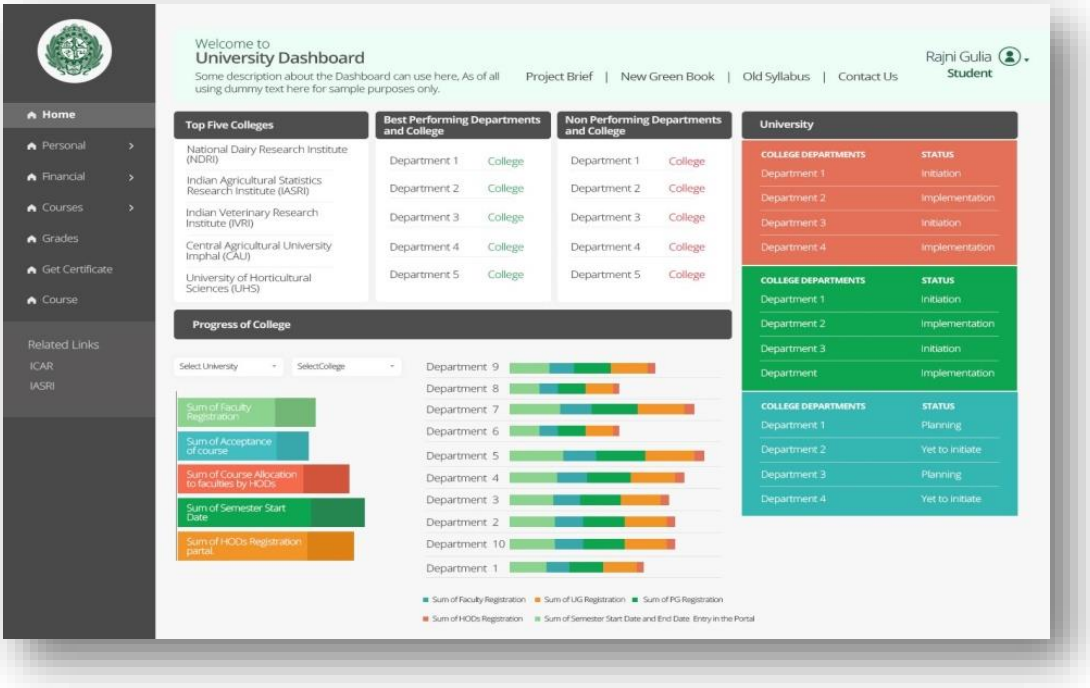
- ***Clean and Green Award Portal***: (Sudeep Marwaha, Anshu Bharadwaj and Shashi Dahiya) This facility has been developed under project "Investment in ICAR Leadership for Agriculture Higher Education" under National Agricultural Higher Education Project 'Component 2'. Green and clean award portal is developed to invite entries from Agricultural Universities to showcase the clean and green initiatives undertaken by them in order to promote sustainable living. The institutions are evaluated on pre-defined parameters by a panel of dignitaries and best universities are awarded cash prizes. The beneficiaries are Agricultural Universities under NAHEP. So far, 31 Agricultural Universities have registered in this portal.



- ***KRITAGYA Portal***: (Sudeep) This portal has been developed under project "Investment in ICAR Leadership for Agriculture Higher Education" under National Agricultural Higher Education Project 'Component 2'. KRITAGYA Portal is developed with an objective to automate end to end modules of national level ag-tech hackathons. KRI-TA-GYA explains KRI for Krishi

(Agriculture), TA for Taknik (Technology) and GYA for Gyan (Knowledge).It is available on : https://nahep.icar.gov.in/kritagya.aspx. The beneficiaries are stakeholders in Agriculture Sector in India. So far, more than 784 teams have registered for this hackathon.

- ***Academic Management System AMS*:** (Sudeep) This facility for 52 Universities has been developed under project Investment in ICAR Leadership for Agriculture Higher Education" under National Agricultural Higher Education Project 'Component 2'. AMS is customized and implemented with an objective to automate all the academic activities in the Agricultural Universities to enhance the efficiency of the overall academic system by saving time and efforts involved in manual process. It is available on - https://auams.icar.gov.in. The beneficiaries are all the stakeholders of agricultural universities across India. So far, there are 52 Registered Universities, 200 registered institutes/colleges, 15,000+ approved students, 6000+ Faculty approved.



AMS - University Health Index (UHI)

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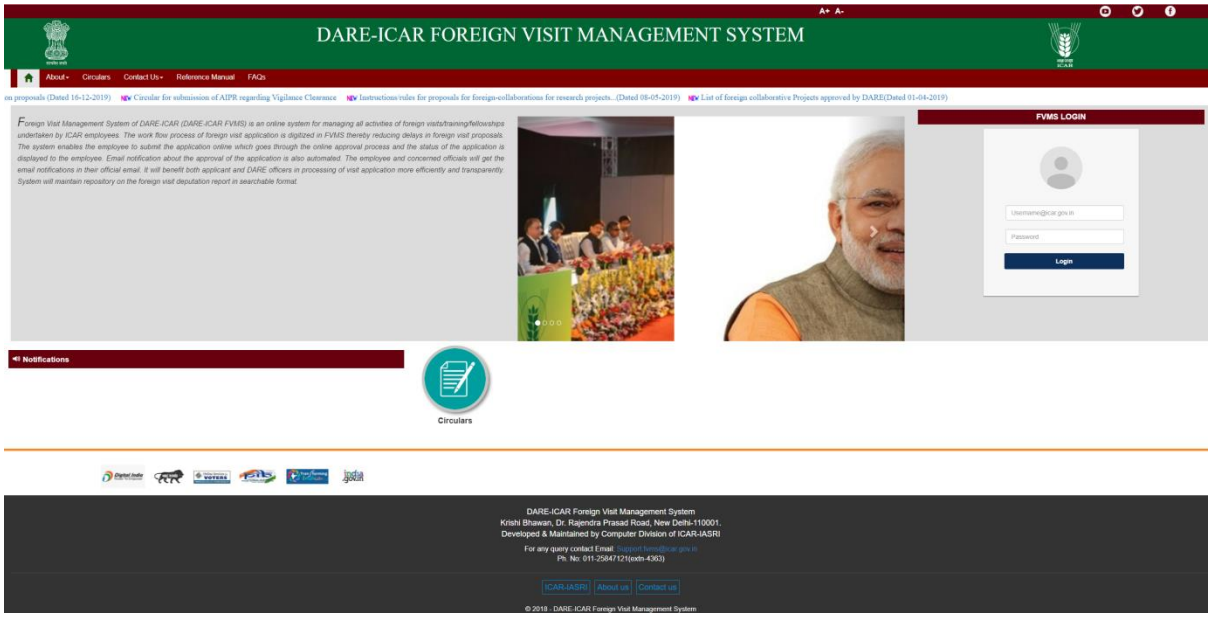
- ***Training Management Information System (TMIS)*:** (Shashi Dahiya, Sudeep Marwaha and Sangeeta Ahuja) This has been developed under project Training Management Information System for ICAR (TMIS). TMIS has been designed, developed and implemented in all ICAR institutes catering to the complete training data management and online decision support in ICAR. The training processes implemented are: Training Needs Assessment (Annual Training Plan), Training Application Process (Application Submission and Approval), Training Feedback Process and Training Evaluation Process (Performance indicators). It is available is on https://hrm.icar.gov.in. The beneficiaries are all ICAR Employees and the HRM unit of ICAR. So far, more than 500 training Needs submitted through this portal.

- ***DARE-ICAR Foreign Visit Management System (FVMS)*: (Sudeep Marwaha)** DARE-ICAR FVMS is an online system for managing all activities of foreign visits/training/fellowship undertaken by ICAR employees. The workflow process of foreign visit application is digitized in FVMS there by reducing delay in foreign visit proposals. The system enables the employee to submit the application online which goes through the online approval process and the status of the application is displayed to the employee. The employee and concerned officials get the email notification in their official email. It benefits both application and DARE officers in the processing of visit application more efficiently and transparently. System maintains repository on the foreign visit deputation report in searchable format. The beneficiaries are all ICAR Employees. A total of 859 applications have been submitted, out of which 753 have been processed and 106 are in process.



- ***IASRI Website*:** (Sudeep Marwaha, Alka Arora, Shashi Dahiya and Sunil Bhatia) ICAR – IASRI website has been designed and developed to provide information pertaining to the Institute. The open source technologies such as Wordpress, PHP and MySQL have been used for the development of this website. Many new features and information have been added into the site to make it more comprehensive and informative. The site is available in both English and Hindi languages. Its URL is : https://iasri.icar.gov.in/. The beneficiaries are intra-institute and inter-institute staff, researchers, and academicians. There were 153108 visitors as on June 02, 2021.

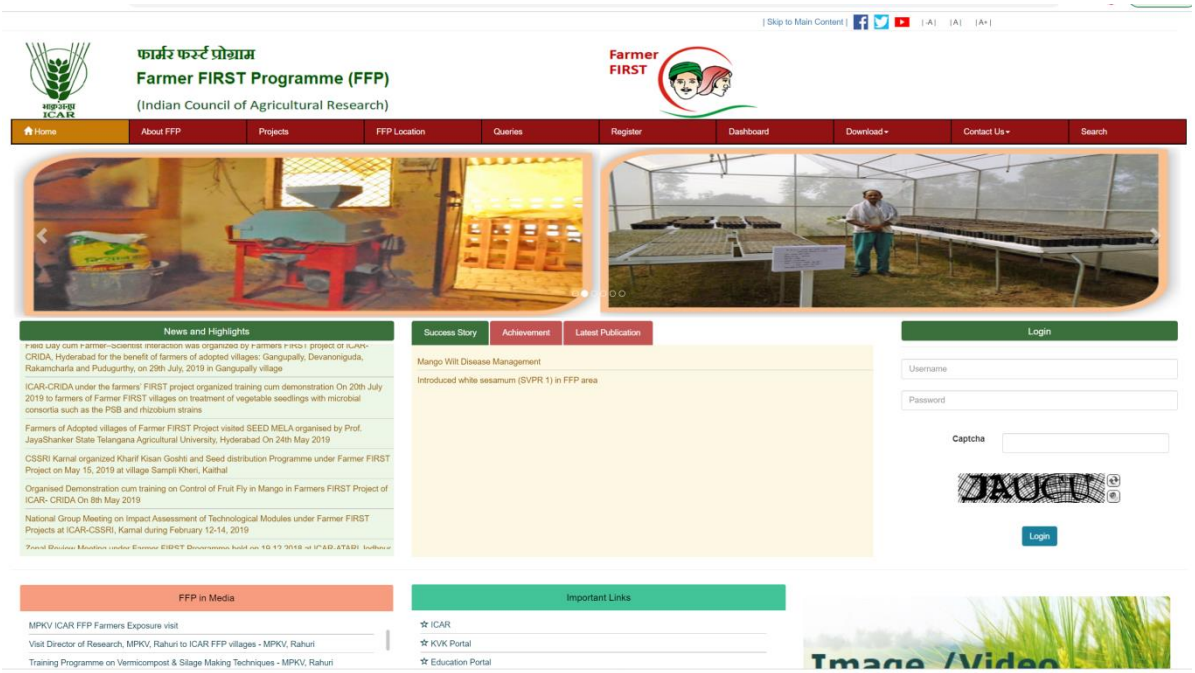
- ***Interactive Voice Response System for Agricultural Nutrition*:** (Shashi Dahiya, ICAR-IARI, New Delhi – Premlata Singh, Satyapriya; KN Singh. Mrinmoy Ray) This system has been developed under the project "ICT Based Extension Strategies for Nutritional Sensitivite Agriculture in the States of UP and Odisha". Interactive Voice Response System for Agricultural Nutrition has been designed and developed for providing complete information about nutritional agricultural crops. User has the option to choose Hindi or Oriya through a toll-free number. The beneficiaries are farmers and extension workers.

- ***Agricultural Nutrition Information System (ANIS)*:** (Shashi Dahiya, ICAR-IARI, New Delhi – Premlata Singh, Satyapriya; KN Singh. Mrinmoy Ray) This system has been developed under the project "ICT Based Extension Strategies for Nutritional Sensitivite Agriculture in the States of UP and Odisha". Agricultural Nutrition Information System has been developed to provide complete information about the Nutri-Dense and Bio-Fortified Crops grown in India. The information includes nutritional profile, health benefits, value added products and production practices of the nutritional crops. It provides information in English. Hindi and Oriya languages. The beneficiaries are farmers and Agricultural Extension Personnel.

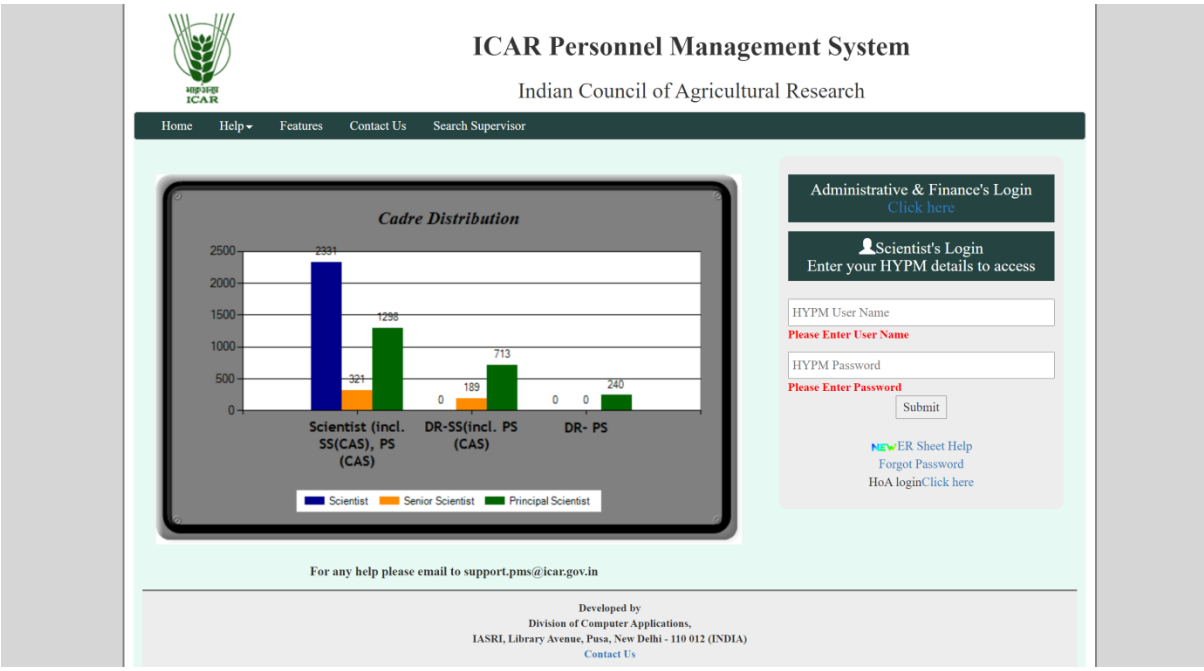
- ***NAHEP Component-2 Website*:** (Sudeep Marwaha, Anshu Bharadwaj, Shashi Dahiya) NAHEP Component 2 website has been designed and developed to provide information pertaining to the project objectives and activities under NAHEP Component 2.Its URL is https://nahep.icar.gov.in/. The beneficiaries are all participating Agricultural Universities under NAHEP 'Component 2'.

- ***Farmer First Program (FFP) Portal*:** (Mukesh Kumar, Anshu Bharadwaj, Soumen Pal) This portal was developed under Management and Impact Assessment of Farmers FIRST Projects. Farmer First Program (FFP) portal is designed and developed to enrich Farmers-Scientist interface, technology assemblage, application and feedback, partnership and institutional building and content mobilization. It is a single window platform which provides basic and details information with respect to all FFP projects. The portal facilitates the lead centers of the respective projects to update and upload all types of related information so that the knowledge generated in FFP can be disseminated to the farming community. Agricultural Technology Application Research Institute (ATARI) and Agricultural Extension Division of ICAR monitor

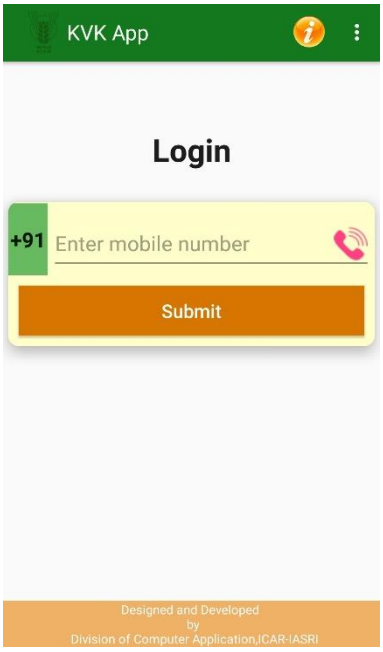
the project activities and progress under this programme through this portal. It is available on https://ffp.icar.gov.in. The beneficiaries are Farmers, Agriculture Universities and Institutes, Extension Division of ICAR. The key statistics include Projects- 52; Interventions- 1182; Events- 868 ; Image- 2910; Video- 112; Publications- 418.

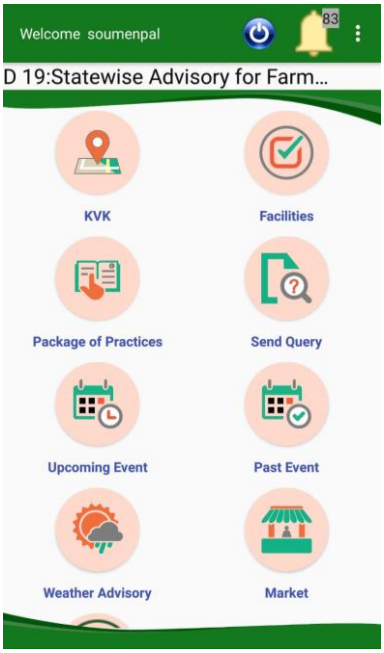


***Personnel Management System (PMS)*:** (Sudeep Marwaha and Alka Arora) PMS has been developed to manage the data related various cadres of ICAR. These cadres include Scientist, Sr. Scientist and Principal Scientist. Besides these, the system also manages the data related to various Tenural and Research Management Positions of the councils such as Head Decisions. Head of the KVK, Joint Directors, Directors, Assistant Director General, Deputy Director Generals. The system manages the profiles of officials that includes parameters such as name, date of birth, age, gender, email, ERP ID, Mobile No., discipline, cadre name, designation etc. It also includes the service profile (posting in the institute from the date of joining till date). It is available on https://pms.icar.gov.in. The beneficiaries are ICAR Officials. The key statistics so far are Posting Application (FOCARS) - 446 (in 7 cycles); Scientist's Transfer Application - 1006 (in 17 cycles); Head KVKs Transfer Application - 04 (in 3 cycles).

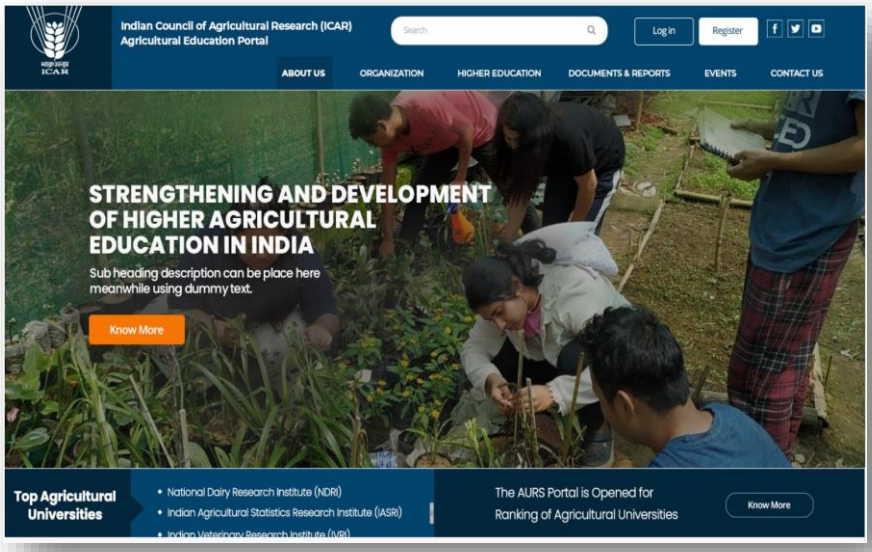


- ***KVK Portal and Mobile Application*:** (Alka Arora, Sudeep Marwaha, Soumen Pal, S.N. Islam, Ajit and Ranjit Kumar Paul). This portal has been developed under project Knowledge Management System for Agriculture Extension Services in Indian NARES. KVK Portal and Mobile App are being used for dissemination and management of information at the KVK level. KVK Portal was used for e-governance of major events like Garib Kalyan Rojgar Abhiyaan (GKRA), Krishi Kalyan Abhiyan–III, Monthly Progress Report (MPR) management of KVK's and data exchange with Darpan dashboard. Advisories were issued during COVID19 lockdown times through KVK portal and mobile App. The beneficiaries are Extension Personnel, Farmers, KVK's, ATARI & Extension Division, ICAR. So far, the portal has been visited 91,67,923 times. In the portal, more than 7 lakhs farmers data are available.



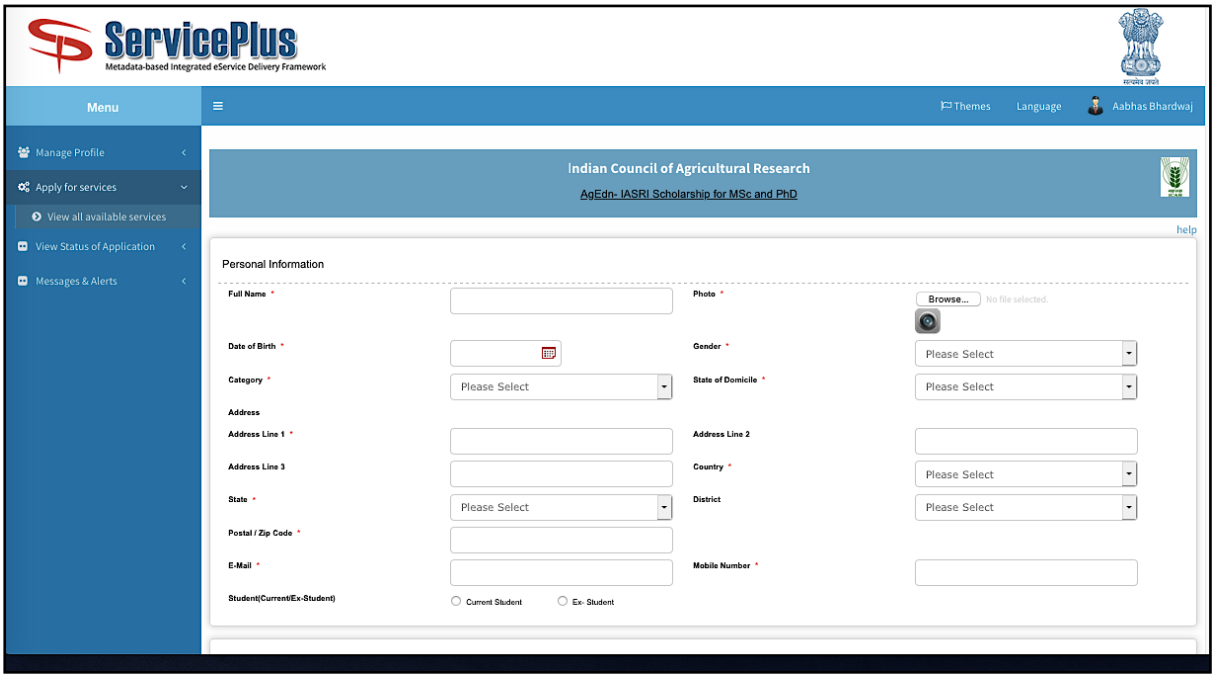


- ***Education Portal*:** (Sudeep Marwaha, Alka Arora, Anshu Bharadwaj, Shashi Dahiya, Pal Singh). This portal has been developed under project National Information System on Agricultural Education Network in India (NISAGENET-IV). Education portal is developed with an objective to provide vital information about all the agriculture universities across the country at the central platform. System also takes care for e-governance of major activities of Education Division, ICAR. Its URL is https://education.icar.gov.in. The beneficiaries are all the Agriculture Education Stakeholders. So far, 1,56,317 unique Student IDs have been generated.

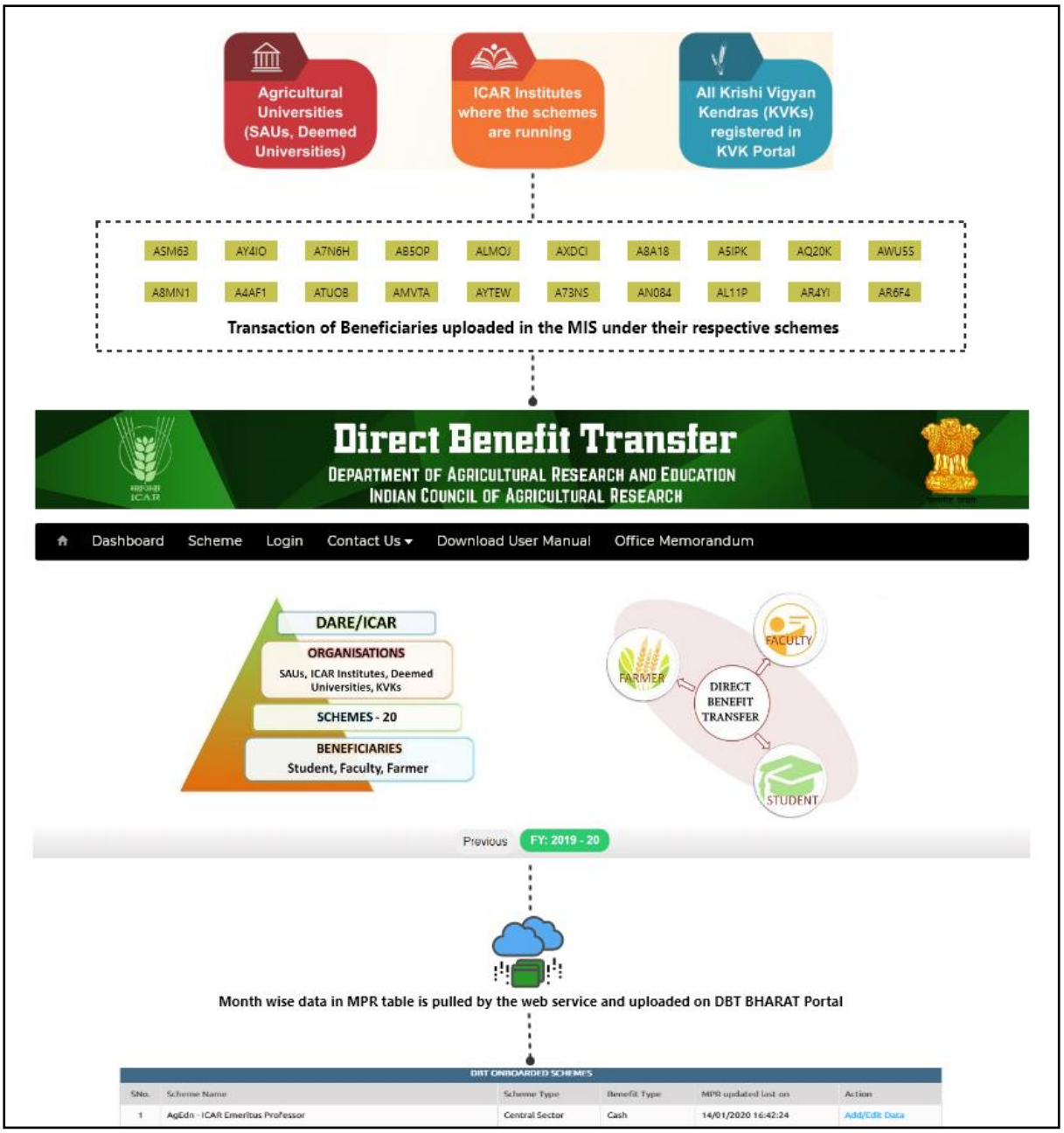


***Service Plus configuration for ICAR-DARE DBT Scheme*:** (Sudeep Marwaha, Soumen Pal, Sanchita Naha and Sapna) ServicePlus is a meta-data based e-Service framework developed by NIC for delivering electronic-services to citizens. This provides all types of components and modules to define, configure and commission an e-service. It involves modules like Service Definition, Service Coverage, Target Beneficiary, Creation of

application forms, Work Flow Player's and tasks mapping and others. DBT Applicable schemes of DARE-ICAR are being configured (in demo server of ServicePlus) following Service Definer Guide (SDG) for each identified scheme for the beneficiaries for accessing service, track submitted applications, subscribe to alerts and integration with PFMS for transferring the money into beneficiaries' accounts. It is available on URL https://dbtdare.icar.gov.in. Beneficiaries under DBT applicable schemes of DARE-ICAR are availing this service.



- ***DBT DARE MIS*****:** (**Soumen Pal**, **Sudeep Marwaha** and **Alka Arora)** This system has been developed under project Development of Direct Benefit Transfer Portal for DARE Schemes. This web based Management Information System (MIS) has been developed for reporting details of beneficiaries and the transactions under all DBT applicable schemes of DARE-ICAR. The schemes include student centric schemes i.e. various scholarships and fellowships, faculty schemes and farmer centric schemes. The information is collated at the scheme level and 20 Monthly Progress Reports (MPRs) are generated on a monthly basis for the 20 schemes in the system. Once approved, the information is moved to DBT Bharat Portal (https://dbtbharat.gov.in/), a national level portal under DBT Mission of India, on each month on a fixed date. The data exchange between two portals is done through Web Application Programming Interface (WebAPI). This MIS is available at https://dbtdare.icar.gov.in. The beneficiaries are the DBT Scheme Managers and DBT Cell of DARE.

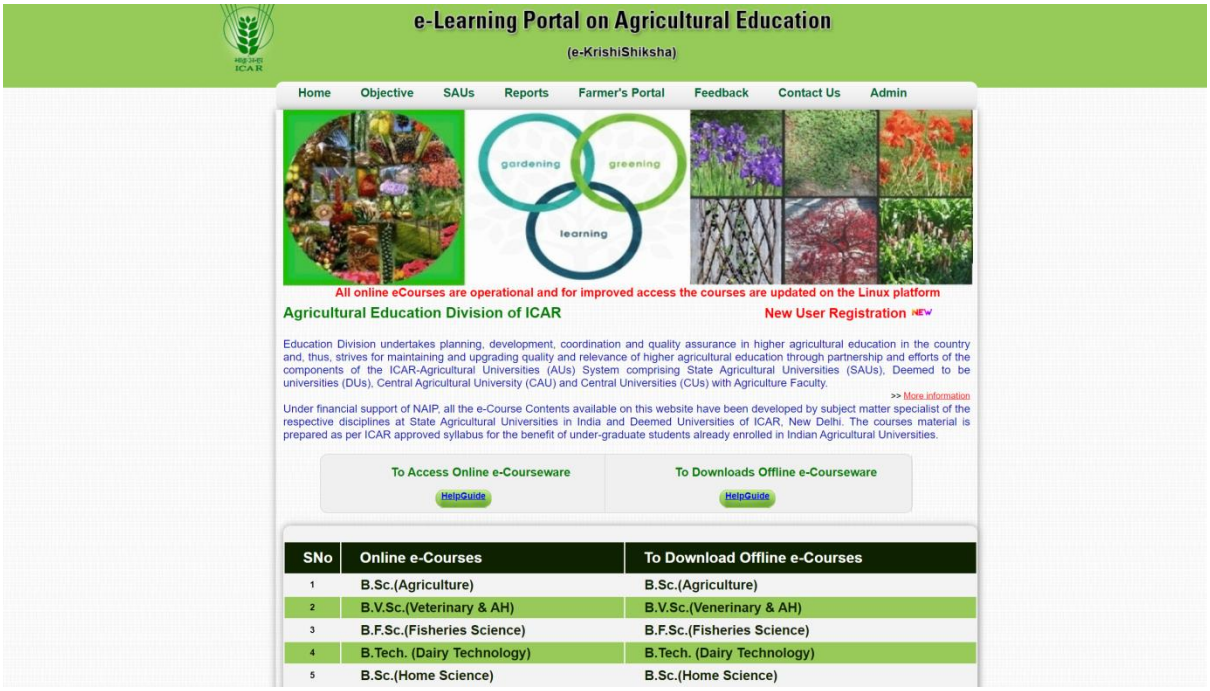


- ***E-Krishishiksha*: (**Sudeep Marwaha) This facility contains standardized course material in the area of Agriculture and Allied sector for undergraduate level. The e-courseware content span across seven disciplines viz. Agriculture Science, Fisheries Science, Dairy Science, Veterinary Science and Animal Husbandry; Horticulture, Home Science and Agriculture Engineering have been developed at SAU/DU and other organizations in India. It is available on https://ecourses.icar.gov.in/Home1.aspx. The system management of this facility is done at our institute.

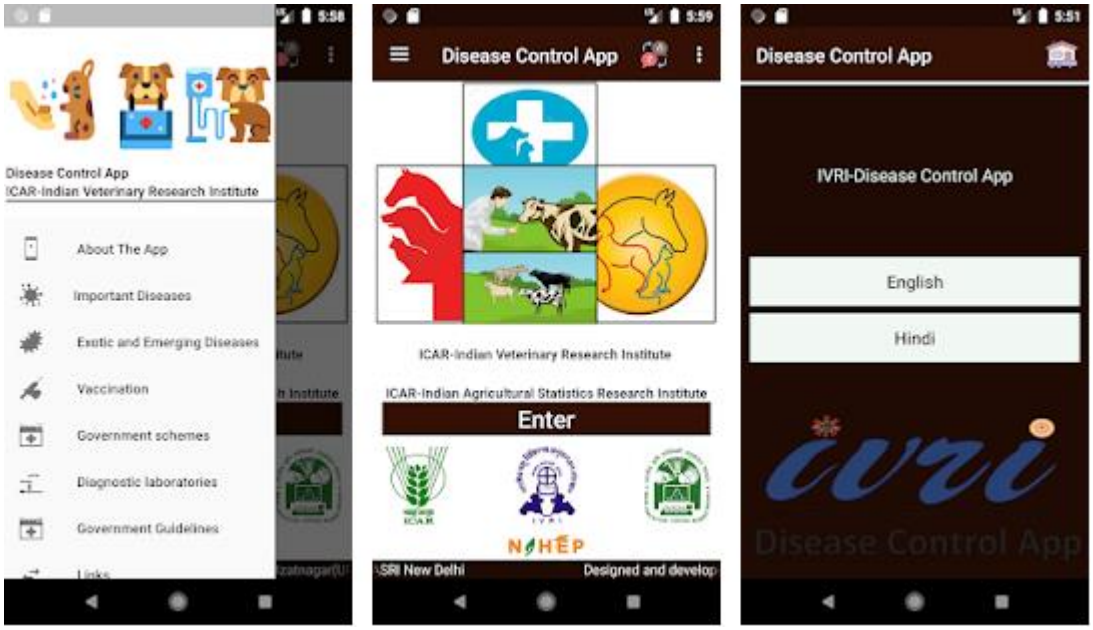
  The beneficiaries are Faculty and Students of Agriculture Universities. Courses downloaded for the portal are as below: (as on 1st December 2020)

  - B.Sc. (Agri)- 165,116
  - B.Sc. (Hort.)- 41,833
  - B.V.Sc. (VT & AH)- 12,403

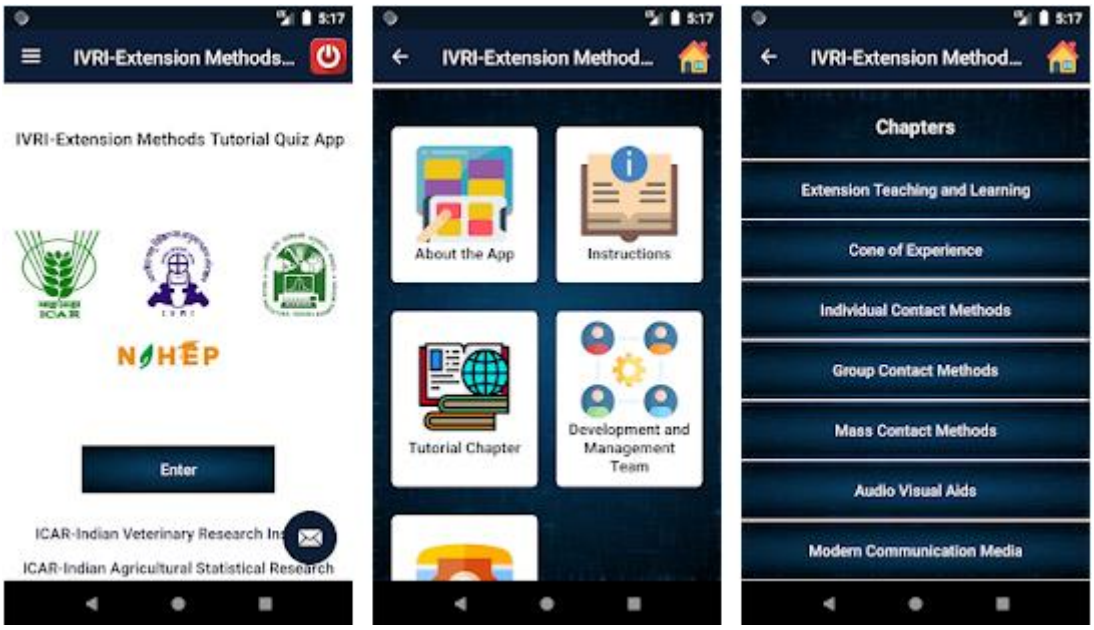
- B.F.Sc. (Fisheries Sci.)- 12,674
- B.Tech. (Dairy Tech)- 19,703
- B.Sc. (Home Sci.)- 7,023
- B.Tech (Agri Eng.) – 30,404



- ***IVRI-Disease Control App*:** (Sudeep, Mukesh Kumar, Soumen Pal) This App has been developed under the project "Development and assessment of educational mobile apps for improving livestock health and production" in collaboration with IVRI. The app (for Android users) is targeted to impart knowledge and skills to Graduating Veterinarians, Field Veterinary Officers, Paravets, Livestock, Poultry and Pet Owners about important diseases of Livestock, Poultry and dogs, their symptoms, diagnosis, treatment, prevention and control. The app also provides information about the Exotic and Emerging diseases apart from Standard Operating Procedure (SOP) for management of disease outbreak, various disease diagnostic laboratories in India, various diagnostic facilities offered by ICAR-IVRI, important organisations involved in disease control and Government schemes and guidelines for disease control in India. The App is presently available in Hindi and English languages. The Google Play Store Link is https://play.google.com/store/apps/details?id=com.icar.ivri.iasri.diseasecontrolapp. The beneficiaries are Graduating Veterinarians, Field Veterinary Officers, Paravets, Livestock, Poultry and Pet Owners. So far, there are 1000+ downloads from Google Play Store.



- **IVRI-Extension Method Tutorial Quiz App** has been developed by **Dr. Sudeep , Dr. Mukesh Kumar, Dr. Soumen Pal** under the project **"Development and assessment of educational mobile apps for improving livestock health and production" in collaboration with IVRI.** The app (for Android users) is a Multiple Choice Questions (MCQ) based Drill and Practice educational learning tool targeted to impart knowledge and skills to students in the various areas of Extension Teaching Methods and Audio Visual Aids. The app contains a total of 10 topics covering the entire gamut of the course. Each topic is divided into three difficulty levels with a set of questions in each: Level-I (Easy Questions), Level –II (Moderately Difficult Questions), Level-III (Difficult Questions). The app will be useful for the students enrolled in UG and PG degree programmes in the Extension Education discipline in various SAU / SVU / CAU, Deemed Universities and colleges of Agriculture, Veterinary, Fishery and Home sciences across the country. It will also be useful for students preparing for various competitive exams and students enrolled in related disciplines. The Google Play Store Link is https://play.google.com/store/apps/details?id=com.icar.ivri.iasri.tutorialapp. The b**eneficiaries** are students in the various areas of Extension Teaching Methods. So far, there are 100+ downloads from Google Play Store.



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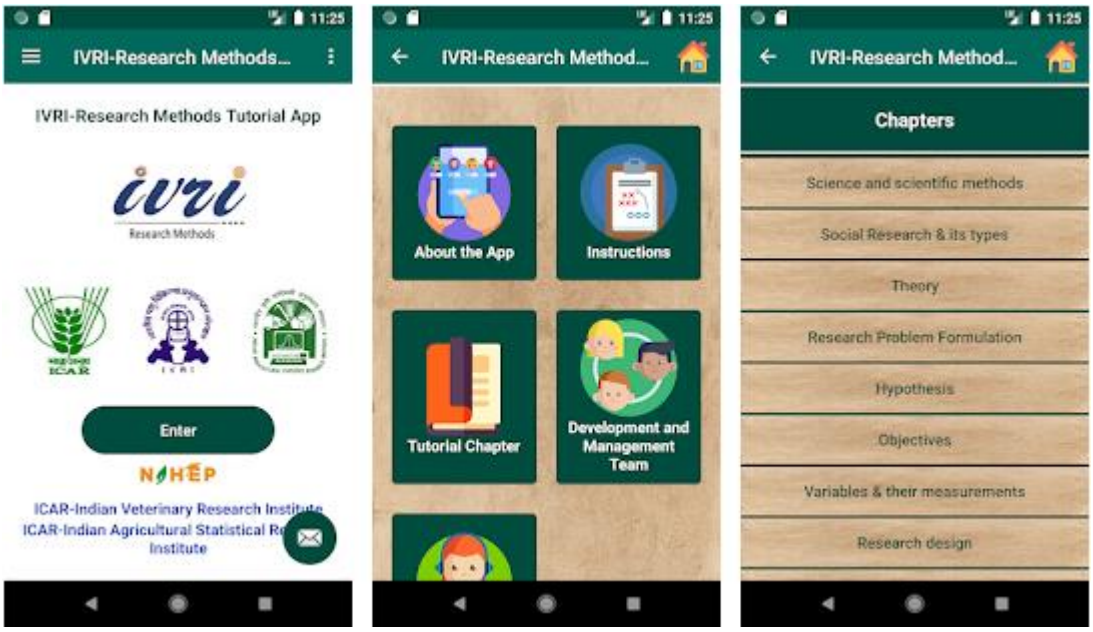

- ***Landscape Diagnostic Survey (LDS) Dashboard*:** (Soumen Pal, Alka Arora, Sudeep, S.N.Islam, Ajit and Ranjit Kumar Paul) under the project "Cereal Systems Initiative for South Asia (CSISA) Integration with KVK Portal". Data on farmer's current crop production practices called Landscape Diagnostic Survey (LDS) have been collected through Open Data Kit (ODK), an Android based digital data collection tool. These data are aggregated and stored at ICAR Data Centre. With these data, a dashboard has been created and linked with Krishi Vigyan Kendra Knowledge Network or KVK Portal and hosted at https://kvk.icar.gov.in/CSISA.aspx. A number of reports and graphics have been developed and integrated into this dashboard. A GPS based report, has been created in which the survey data points can either be located in map view or satellite view.

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- ***SIReDAM- Systematic Information Resources Dairy Animal Management*: (U.B.Angadi, Dinesh Kumar, MA Iquebal, Sarika, Anil Rai)** Virtual demonstration of web system on "SIReDAM- Systematic Information Resources Dairy Animal Management" to AICRP on Cattle team of ICAR-Central Institute for Research on Cattle, Meerut, UP during 9th to 15th July 2020. URL: http://webtom.cabgrid.res.in/SIReDAM/.
    - **Development of integrated model for Genomic Selection (Neeraj Bhudhlakoti)** Under parametric models we have studied most commonly used methods i.e. linear regression, RR, BLUP, GBLUP, LASSO, Bayesian. For nonparametric models we have studied models like RKHS, SVM, NN and RF. It was observed from the result that for additive architecture, GBLUP performed quite well and among nonparametric methods, performance of SVM was found to be encouraging. Keeping these results in the mind, a robust model has been developed for genomic selection studies which can handle additive and epistatic effects simultaneously by minimizing their error variance. Best model from both parametric and nonparametric methods has been identified. Under parametric methods performance of GBLUP, whereas for nonparametric method, SVM was found to be best using various evaluation measures. An integrated estimator for estimation of GEBVs has been developed for genomic selection by combining estimates from both best parametric and nonparametric methods.

      The integrated estimator of GEBV can be expressed as

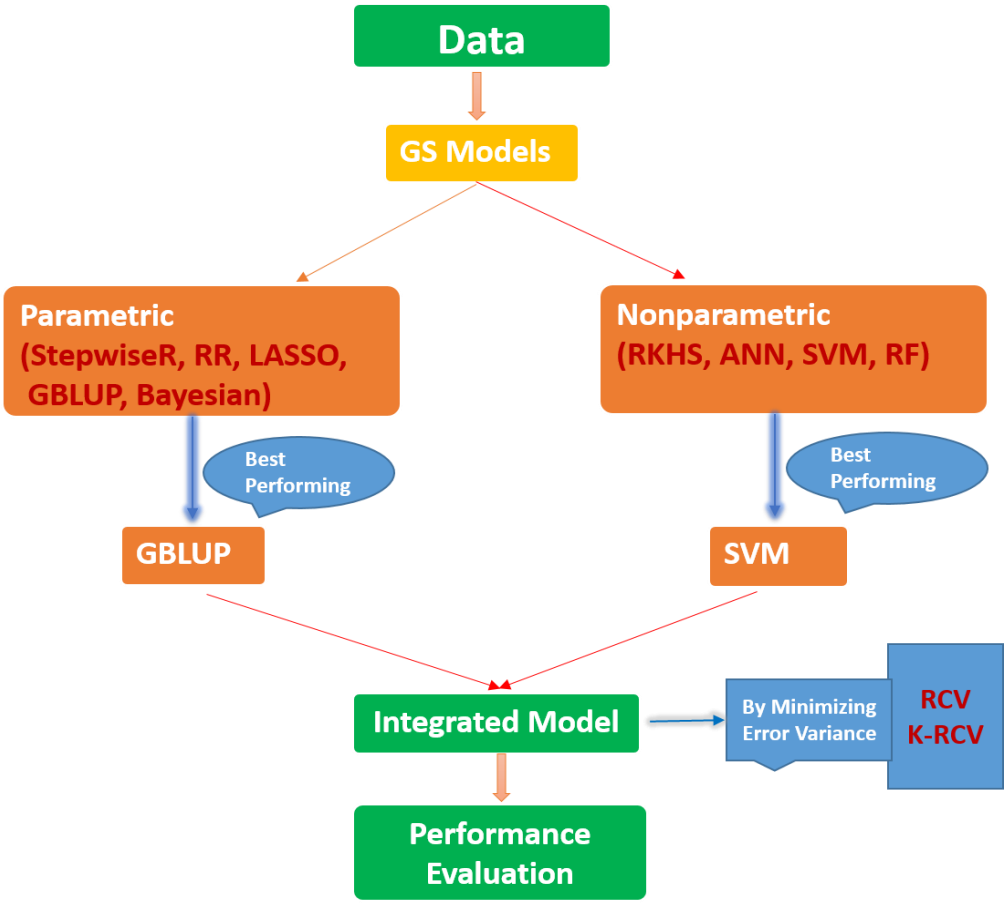
      $$Y_{Est} = wY_{GBLUP} + (1 - w)Y_{SVM}$$

      where, Y_{Est} is new predicted phenotype (GEBVs) from integrated model, w is $\frac{\sigma^2_{SVM}}{\sigma^2_{GBLUP}+\sigma^2_{SVM}}$, where σ^2_{SVM} and σ^2_{GBLUP} are the error variance of models SVM and GBLUP respectively, Y_{GBLUP} is the predicted GEBV from GBLUP whereas Y_{SVM} is the predicted GEBV from SVM model. Let us assume, error variance of Y_{Est} is represented by σ^2_{Est}. Then by optimizing w, σ^2_{Est} can be obtained as:

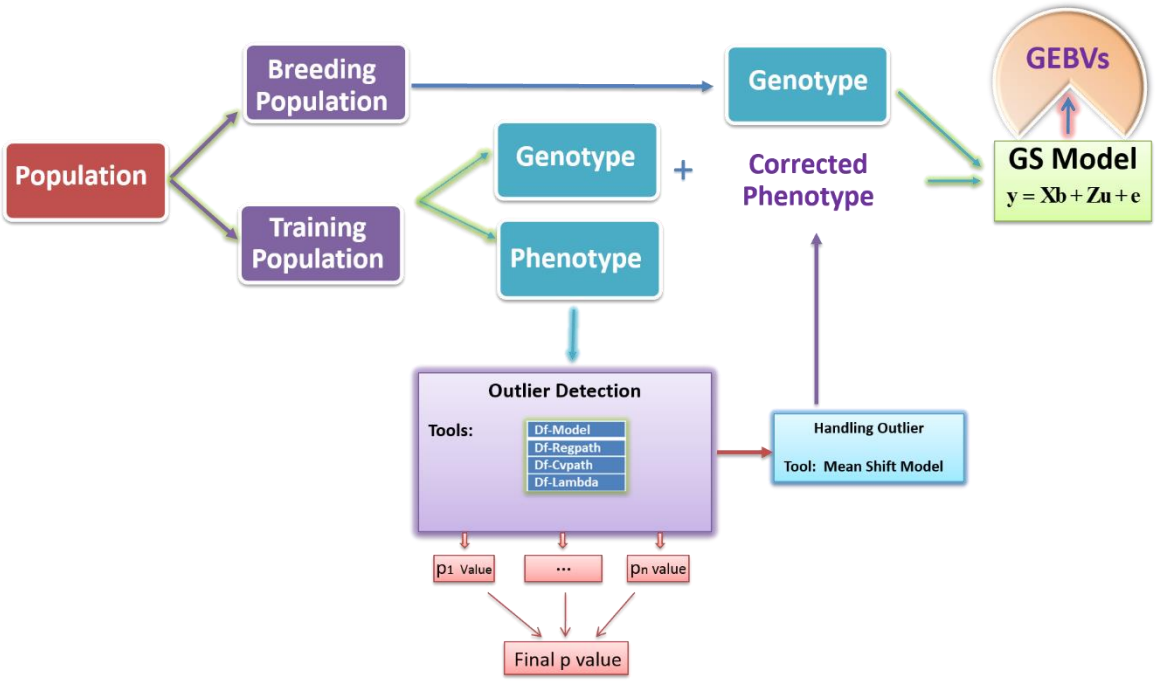
      $$\sigma^2_{Est} = \left(\frac{\sigma^2_{SVM}}{\sigma^2_{GBLUP} + \sigma^2_{SVM}}\right)^2 \sigma^2_{GBLUP} + \left(\frac{\sigma^2_{GBLUP}}{\sigma^2_{GBLUP} + \sigma^2_{SVM}}\right)^2 \sigma^2_{SVM}$$

      $$\sigma^2_{Est} = \frac{\sigma^2_{GBLUP}\sigma^2_{SVM}}{\sigma^2_{GBLUP}+\sigma^2_{SVM}}$$

      Flow diagram of procedure followed to develop the methodology is given below.


Data
GS Models
Parametric
(StepwiseR, RR, LASSO,
GBLUP, Bayesian)
Nonparametric
(RKHS, ANN, SVM, RF)
Best
Performing
Best
Performing
GBLUP
SVM
Integrated Model
By Minimizing
Error Variance
RCV
K-RCV
Performance
Evaluation

- **Statistical Approach for Improving Genomic Prediction Accuracy through Efficient Diagnostic Measure of Influential Observation (Neeraj Budhlakoti)** Genomic selection procedures have proven to be useful in estimating breeding values and predicting phenotype using genome-wide molecular marker information. Number statistical methods has been proposed to predict individual breeding values by modeling the relationship between individual genotype and phenotype. Genomic selection methods have been successfully applied for plants and animals. However, success of genomic selection depends on the quality of the data suitable for implementing the various statistical models. But in practical situation genomic data quality seldom fulfill the ideal condition and often having many constraints such as presence of influential observations, missing points, noise etc. Influential observations can potentially have devastating effects on genome estimated breeding values. It is expected the predictive performance of genomic prediction methods may be adversely affected in the presence of influential observations or outliers. In agriculture science an outlier may arise due to wrong data imputation, outlying response, and in a series of trials over the time or location. Although several statistical procedures are already there in literature for identification of outlier but identification of true outlier is still a challenge especially in case of high dimensional genomic data. Here we have proposed an efficient approach for detecting outlier in high dimensional genomic data, our approach is p-value based combination methods (i.e. inverse chi, logit, meanp, meanz, sumz, sumlog, sump) to produce single p-value for detecting the outliers. Robustness of our approach has been tested using simulated data through the evaluation measures like precision, recall etc. It has been observed that significant improvement in the performance of genomic prediction has been obtained by detecting the outliers and handling them accordingly through our proposed approach using real data. Operational workflow of the whole procedure used to develop the methodology is given below.



A user friendly R package was also developed for above mentioned methodology. This package identifies influential observation by implementing meta-analysis based approach to combining various least absolute shrinkage and selection operator (LASSO) based diagnostic (Rajaratnam (2019) doi:10.1080/10618600.2019.1598869) in genomic data hence named as OGS (i.e. outlier in genomic data) based on their p-value. This package identifies outlier in genomic data using different p-value combination methods (i.e. inverse chi, logit, meanp, meanz, sumz, sumlog, sump) with suitable p-value cutoff.

- ***Software Developed - Development of Web based Tool for Computation of Genomic Signatures*****:** (Mailarlinga, S. B. Lal, Anu Sharma, D. C. Mishra, Sudhir Srivastava and Hukum Chandra) Composition features of biological sequences are medium by which various species can be distinguished. Different genomic signatures such as GC content, Amino acid content, Synonymous codon usage, Di-nucleotide odd ratio and Chaos Game Representation (CGR), Average Mutual Information Profile (AMIP) and Oligonucleotide Frequency Derived Error Gradient (OFDEG) were computed by developing web-based application. The compatible software modules have been developed for two signatures namely OFDEG and AMIP. This web-based tool was developed to provide a single comprehensive platform for computing all these genome signatures for user supplied genomic sequence data and other required parameters, if any. This tool would save time of those researchers who needs to generate all signature indices at once. It will also help the researchers and biologists in their research related to metagenomics binning, drug designing, protein classification, phylogenetic analysis, molecular breeding, biofertilizer development, expression analysis, medical sciences etc.

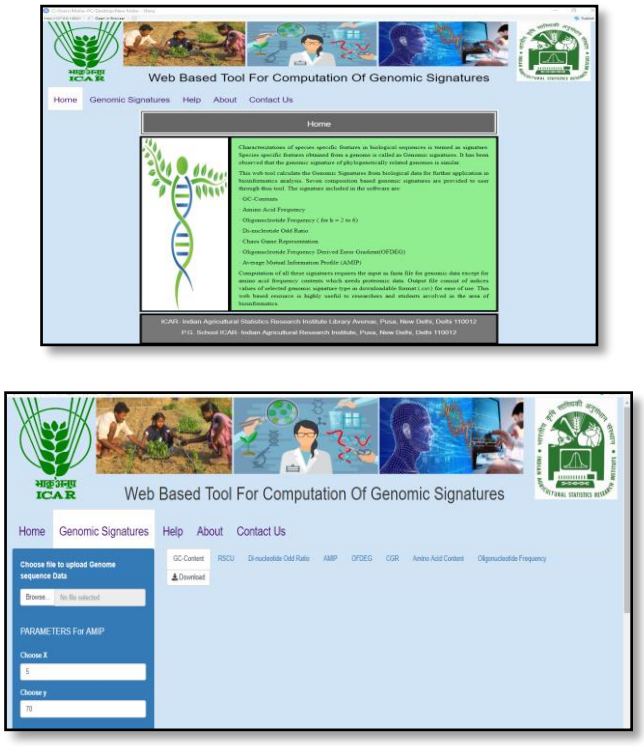


Fig. 1: Software Home and Signature Computation page

- ***Mobile App - Soil Nutrient Based Mobile App for Crop-Wise Fertilizer Recommendation*: (**Lalit Birla, SB Lal, Anu Sharma, KK Chaturvedi, MS Farooqi and Hukum Chandra*)* Mobile app 'SoilNutro" provides the nutrient status of a specific location of users. This app uses data from Soil Health Cards (SHCs) portal. Robotic process automation is a technology that allows the configuration of computer software or "robots" to simulate and integrate human interaction actions within digital systems. *UiPath Studio* software implements RPA (Robotic Process Automation) based technology which was used for downloading data from the website https://soilhealth.dac.gov.in. This app allows user to get current location automatically via GPS system. This feature of application displays user location latitude, longitude, city and address along with pincode of user's current location. It first provides information about nutrient content of user's location by using soil health data. This app also provides crop-wise fertilizer advisory through which application advises the users about fertilizer doses would be needed to supply on their field. This app displays two combination of fertilizer doses that should be apply on field for efficient use of fertilizer. First combination includes Urea, Single Super Phosphate (SSP) and Potassium Chloride (MOP) in kilogram per hectare. And second combination includes Diammonium Phosphate (DAP), Urea and MOP.

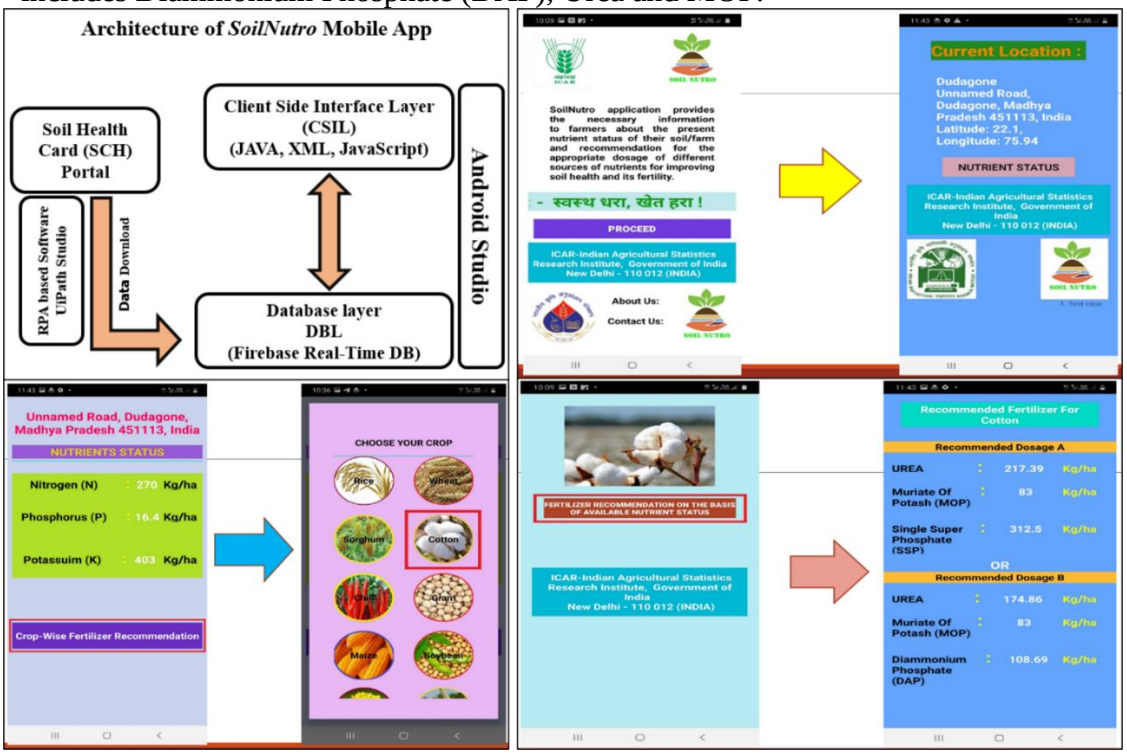


Fig. 2: *SoilNutro* App Architecture and app screens

- ***R package GenoSig***: (Anu Sharma, S.B. Lal, Sanjeev Kumar, D.C. Mishra) The package is developed for the computation of genomics signatures for metagenomics data. This package contains methods for computation of k-mer frequency, GC contents, amino acid frequencies, synonymous codon usage indices, Dinucleotide Odd Ratio, Chaos Game Representation, Oligonucleotide Frequency Derived Error Gradient(OFDEG) and Average Mutual Information Profiles. This package will be highly useful for research community in automatic computation of genomics signature using a single platform.

- Web Based Software for the computation of genomic signatures of metagenomics data: (Anu Sharma, S.B. Lal, Sanjeev Kumar, D.C. Mishra)

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Home Page of GenoSig

- ***Categorization of drought resistance wheat genotypes base on image features*:** (Sanjeev Kumar, Anil Rai and Anu Sharma) An innovative methodology has been developed for categorization of Images of total 184 RILs of wheat (C306 x HD2697) and 2 parental lines with three replications under drought stress and control from phenomics facility of IARI. Data is collected from three types of camera (image angles) viz. Visual (4 angles), NIR (2 angles) & IR (2 angles) at 18 phases covering growth period of wheat during January to March 2018. Methodology was applied on these RILs wheat cultivars to classify the them into different groups with respect to drought stress. Analysis of data including pre-processing and cleaning, variable selection, SVM classification, K-mean clustering, hierarchical clustering, PCA and Estimation of heritability, repeatability and genetic correlation. Maximum Likelihood Estimation method has been used for the estimation of component of variances viz. Phenotypic (Total), Genetic (G), Treatment (T), Interaction (GxT) and error at every 18 growth stages of phenotyping has been done.

Chapter 5
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 subsequently.

1. DEGREE COURSES

The Institute continued to conduct 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 Agricultural Statistics/ Computer Application/ Bioinformatics but also in Agricultural Sciences like Genetics, Agronomy, Agricultural Economics, etc. The Courses in Mathematics, Agricultural Statistics, Computer Application and most of Bioinformatics, are offered at this Institute while the courses in Agricultural Sciences are offered at ICAR-IARI, New Delhi.

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

S. No.	Course	No. of Students	
		Admitted	Passed Out
1	Ph.D. (Agricultural Statistics)	09	05
2	M.Sc. (Agricultural Statistics)	06	07
3	Ph.D. (Computer Application)	07	03
4	M.Sc. (Computer Application)	07	06
5	Ph.D. (Bioinformatics)	08	01
6	M.Sc. (Bioinformatics)	04	05

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

S. No.	Name	Year of Induction
1.	Dr. Rajender Parsad, Principal Scientist & Director from 09.10.2020	1995
2.	Dr. Tauqueer Ahmad, Principal Scientist & Director (A) till 08.10.2020	1998
3.	Dr. Seema Jaggi, Professor (Agricultural Statistics)	1995
4.	Dr. L.M. Bhar, Principal Scientist	1998
5.	Dr. Anil Rai, Principal Scientist	1995
6.	Dr. K.N. Singh, Principal Scientist	2011
7.	Dr. Amrit Kumar Paul, Principal Scientist	1998

8.	Dr. Girish Kumar Jha, Principal Scientist (at ICAR-IARI)	1999-2005; 2006
9.	Dr. Cini Varghese, Principal Scientist	2000
10.	Dr. Himadri Ghosh, Principal Scientist	2004
11.	Dr. Ajit, Principal Scientist	2015
12.	Dr. Anil Kumar, Principal Scientist	2010
13.	Dr. Prawin Arya, Principal Scientist	2003
14.	Dr. Hukum Chandra, National Fellow	2003
15.	Dr. Prachi Misra Sahoo, Principal Scientist	2002
16.	Dr. Ramasubramanian V., Principal Scientist	1999-2013; 2017
17.	Dr. Amrender Kumar, Senior Scientist (at ICAR-IARI)	2003
18.	Md. Wasi Alam, Senior Scientist	2003
19.	Dr. Ranjit Kumar Paul, Senior Scientist	2011
20.	Dr. B.N. Mandal, Senior Scientist	2011
21.	Dr. Susheel Kumar Sarkar, Senior Scientist	2011
22.	Dr. Mir Asif Iquebal, Senior Scientist	2011
23.	Dr. Kaustav Aditya, Scientist	2012
24.	Dr. Sukanta Dash, Scientist	2013
25.	Dr. Arpan Bhowmik, Scientist	2014
26.	Dr. Ankur Biswas, Scientist	2015
27.	Dr. Anindita Datta, Scientist	2017
28.	Dr. Sarika, Senior Scientist	2018
29.	Mr. Deepak Singh, Scientist	2018
30.	Dr. Achal Lama, Scientist	2018
31.	Dr. Pradip Basak, Scientist	2018
32.	Dr. Mrinmoy Ray, Scientist	2018
33.	Dr. Raju Kumar, Scientist	2019
34.	Dr. Vandita Kumari, Scientist	2019
35.	Dr. Kanchan Sinha, Scientist	2019

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

S. No.	Name	Year of Induction
1.	Dr. Sudeep Marwaha, Head & Professor (Computer Application)	2002
2.	Dr. Alka Arora, Principal Scientist	2001
3.	Dr. K.K.Chaturvedi, Principal Scientist	2002
4.	Dr. Anshu Bharadwaj, Principal Scientist	2004
5.	Dr. S.B. Lal, Principal Scientist	2004
6.	Dr. Rajni Jain, Principal Scientist (at ICAR-NIAP)	2007
7.	Dr. A.K. Mishra, Principal Scientist (at ICAR-IARI)	2014
8.	Dr. Mukesh Kumar, Principal Scientist	2014
9.	Dr. Shashi Dahiya, Senior Scientist	2001
10.	Dr. Md. Samir Farooqi, Senior Scientist	2001
11.	Dr. Anu Sharma, Senior Scientist	2004
12.	Dr. Sangeeta Ahuja, Scientist	2002
13.	Sh. Pal Singh, Scientist	2010
14.	Ms. Shaloo, Scientist (at WTC, ICAR-IARI)	2016
15.	Dr. S.N. Islam, Scientist	2018
16.	Dr. Soumen Pal, Scientist	2019

4. FACULTY MEMBERS OF P.G. SCHOOL, IARI IN BIOINFORMATICS

S.No.	Name	Year of Induction
1.	Dr. Rajender Parsad, Principal Scientist & Director from 09.10.2020	2010
2.	Dr. Anil Rai, Head (CABin) (A); ADG(ICT)& Professor (Bioinformatics)	2010
3.	Dr. Seema Jaggi, Principal Scientist	2010
4.	Dr. S.S. Marla, Principal Scientist	2010
5.	Dr. Sudeep Marwaha, Principal Scientist	2010
6.	Dr. Kishore Gaikwad, Principal Scientist (at ICAR-NRCPB)	2010
7.	Dr. P.K. Singh, Principal Scientist (at ICAR-IARI)	2010
8.	Dr. A.K. Mishra, Principal Scientist (at ICAR-IARI)	2010
9.	Dr. S.B. Lal, Principal Scientist	2010
10.	Dr. Monendra Grover, Principal Scientist	2013
11.	Dr. K.K. Chaturvedi, Principal Scientist	2014
12.	Dr. U.B. Angadi, Senior Scientist	2014
13.	Dr. Mohd. Samir Farooqi, Senior Scientist	2010
14.	Dr. Anu Sharma, Senior Scientist	2010
15.	Dr. Sunil Archak, Principal Scientist	2010
16.	Dr. D.C. Mishra, Senior Scientist	2010
17.	Dr. Sarika, Senior Scientist	2010
18.	Sh. Sanjeev Kumar, Scientist	2010
19.	Dr. Mir Asif Iquebal, Scientist	2013
20.	Dr. M.G. Mallikarjuna, Scientist (at IARI)	2017
21.	Dr. Yasin Jeshma K., Scientist (at NBPGR)	2018
22.	Dr. Sudhir Shrivastava, Scientist	2019

5. DISSERTATIONS APPROVED

Ph.D. (Agricultural Statistics)

Name: Vandita Kumari **Chairman: Dr. Hukum Chandra**

Roll No: 10091

Title of Thesis: Regression Analysis from Sample Survey Data using Calibration Approach

Complex sampling designs are often implemented to select a representative sample from the target population. The sampling weights, also referred as the design weights, are then used in the analysis of survey data to account for complex sampling design. In many practical applications, the interest is not only to estimate finite population total (or mean) but also to estimate some complex parameter like the estimation of population regression coefficients. The regression coefficients are often required to establish the structural relationship between variables. The unweighted (or ordinary least square) estimators of regression coefficients are often biased for survey data collected using complex sampling designs. The survey weighted estimates of regression coefficients are used for the complex survey data. The calibration approach is commonly employed in survey estimation to modify the sampling design weights using auxiliary information to produce efficient estimator for the finite population parameters. This thesis develops efficient estimator of regression coefficients by extending the calibration approach. In particular, calibrated estimators are developed based upon the auxiliary variable(s) correlated with the dependent and/or explanatory variable. The

estimators of variance of proposed estimators are also developed using two approaches namely, analytical and bootstrap. The performance of the proposed estimators along with its corresponding variance estimators are evaluated through simulation studies. The empirical results based on simulation studies using both synthetic population and real data show that the developed estimators perform better than the existing estimator. Further, the empirical results reveal that both analytical and bootstrap variance estimators perform reasonably well.

Name: Amit Saha **Guide: Dr. K. N. Singh**
Roll No.10765
Title of Thesis: A Study on Spatio Temporal Time Series Modeling and Forecasting

In recent times, spatio temporal time series forecasting is an evolving research area. Spatial temporal series is the time series which shows spatial dependencies, whereas the time series data depicts only the temporal dependencies of the data. Spatio temporal data are the data which are taken over the time and space as well. Spatio temporal time series analysis incorporates more information as compared to time series analysis alone in many domains including agriculture, traffic, meteorology, economics, disease mapping, sociology, environmental sciences, ecological sciences etc. Spatial weight grid incorporates the information of different location on a particular location. Now days, STARMA models are mostly used models to do work with the spatio-temporal time series data which have static correlation among them. STARMA model has the capability to model multiple time series which are placed on different sites and indeed these space time series have spatial and temporal correlations. Usually, uniform weight matrix is used to incorporate the spatial information of various sites. The drawback of the uniform spatial weight matrix is that all the neighbors may not affect equally to the environment of a certain site. Hence, there is a need to develop a new weight matrix which would be statistically sound based on the fuzzy inference system (FIS). Empirical results have revealed the superiority of proposed STARMA model based on FIS as compare to conventional STARMA. On the other hand, being a linear model, STARMA model cannot deal with the non-linearity pattern exists in the data. Whereas, machine learning techniques have the ability to deal with the non-linearity. However, they are not always able to handle both linear and non-linear pattern with the equal importance. Therefore, in this study a hybrid approach has been proposed by integrating STARMA with machine learning techniques viz., Artificial Neural Network (ANN) and Support Vector Machines (SVM) which has the strength of both linear and nonlinear modeling. Empirical results revealed the superiority of proposed hybrid model based on machine learning techniques as compare to conventional STARMA. The main drawback of STARMA model is the assumption of linearity which not always feasible while dealing with real world data. Over the last decade, nonlinear 2 time series models have been gradually increasing in many fields. So, an attempt has been made to propose a new non-linear model for spatiotemporal series forecasting based on fuzzy techniques. In the last three decades, various univariate methods have been developed for forecasting the time series based on fuzzy techniques. Since these methods are only valid for the single time series, it cannot utilize for spatio-temporal time series. To overcome these limitations, a new forecasting method has been proposed employing fuzzy techniques in conjunction with the k-means clustering which can deal with the non linear space-time data.

Name: Priyanka Anjoy **Guide:** Dr. Hukum Chandra
Roll No.10762
Title of Thesis: Small Domain Inference from Survey-weighted Counts

In the context of the 2030 agenda of Sustainable Development Goals (SDGs) to '*Leave No One Behind*', the disaggregate level statistics is essential and cannot be ignored to meet the goals. Such disaggregate or micro level statistics cannot be generated using standard survey estimation methodologies. The way in which we can reconcile the need for decentralized level official statistics upto a desired degree of reliability as well as representativeness is the Small Area Estimation (SAE) approach. SAE methodologies generate precise small area statistics without

incurring any extra cost and utilizing existing survey and administrative data. Standard SAE approaches for estimating small domain proportions using aggregate level data often ignore the underlying sampling mechanism. Whereas, incorporation of complex survey design information is crucial in the sense, small area models that do not allow available survey information are subjected to produce potentially large biases in the resultant estimates. Again, most of the researchers have advocated Hierarchical Bayes (HB) paradigm to draw needful small domain inference, which facilitates meaningful interpretation of statistical conclusions in contrast to frequentist or non-Bayesian framework. Consequently, the strategic idea is to prefer HB modeling of survey-weighted proportions. Estimators are proposed for modeling of survey-weighted proportions both in absence and presence of spatial nonstationarity in the data. Empirical investigations show the superiority of proposed HB small area estimators which consider the incorporation of survey-weight over the estimator not accounting for survey-weight. Developed HB models are implemented to generate reliable and representative disaggregated level statistics. Specifically these applications include estimation of disaggregate level food insecurity and poverty incidence in Odisha, disaggregated level disparity in poverty incidence in Chhattisgarh, district-wise estimation of the incidence of indebtness in Bihar and district-wise estimation of the proportion of indebted - ST, SC, OBC and Others category farm households in the state of Karnataka. Spatial maps produced using such estimates are certainly helpful to the policy makers for quick identification of the deprived segments of population and framing targeted policy plan.

Name: Manju Mary Paul **Guide: Dr. Anil Rai**

Roll No. 10089

Title of Thesis: Development of robust technique of association for genome wide case-control studies

Analysis of SNPs and haplotypes offer a promising new research avenue for finding association of genes with complex diseases. Prospective and retrospective likelihoods are the two common approaches used to study this association in case of SNPs. In this study, for SNPs, a method based on Preliminary test, has been proposed, which is efficient than prospective approach by exploiting model assumptions of Hardy Weinberg Equilibrium (HWE) and robust against failure of model assumptions as compared to retrospective approach. Haplotypes, are SNPs which are the linked together in a chromosome and are inherited together. Association analysis using haplotypes is also gaining importance. Model-free and model-based method are the two commonly followed approaches for the analysis of haplotype data. A Preliminary Test Estimator for the analysis of haplotype data has been proposed by utilizing model free and model based method. The proposed PTE has been empirically evaluated through a simulation study of SNPs. Simulation study was performed to test the efficiency of the proposed estimator. Different situations where population follows Hardy Weinberg Equilibrium, small, moderate and large deviations from HWE were simulated. The Preliminary Test Estimator developed can be seen as robust against the deviation from Hardy Weinberg Equilibrium. The percent bias is seen to be least at situation where HWE assumption is followed. As deviation from HWE increases, PTE is found to be less biased as compared to the retrospective methods. The % gain in efficiency also found in between the two existing methods which makes it a reliable and robust estimator at all situations. Thus Preliminary Test Estimator developed was found to be s robust against the deviation from HWE.

Name: Pankaj Das **Guide: Dr. Girish Kumar Jha**

Roll no.-10683

Thesis title: Study on Machine Learning Techniques based Hybrid Model for Forecasting in Agriculture

Agricultural dataset are mostly nonlinear, nonstationary and leptokurtic in nature. These properties of dataset poses a variety of problems in forecasting. Precise forecasting helps both farming community and policy makers to undertake informed decisions. Literature suggests that each of the forecasting models has their own limitations. A single forecasting model is not able to handle problems like non-stationary and nonlinearity simultaneously. Accordingly, the present study proposes three different hybrid models*i.e.* empirical mode decomposition based support vector regression (EMD-SVR), time delay neural network with error correction term (TDNN-ECT) and multivariate adaptive regression splines based artificial neural network (MARS-ANN) models. The novelty of these models lies in the fact that they can handle both non-stationary and nonlinear features of dataset simultaneously. In EMD-SVR model, the nonstationary and nonlinear dataset is decomposed into different intrinsic mode functions and final residue through EMD method. Then the decomposed components are forecasted using SVR model and finally, all forecasted values are summed up to produce the final forecast. In the second model, TDNN-ECT uses the error correction term from the two co-integrated series as auxiliary variable. The auxiliary information in the form of ECT improves the forecasting accuracy. Further, selection of important input variables is a crucial step in determining the accuracy of any forecasting model. Hence, MARS-ANN hybrid model was developed in which the MARS algorithms was employed to extract important factors determining crop yield and the extracted factors were used for yield prediction using ANN methodology. The performance of proposed hybrid models are evaluated with individual forecasting models using three different agricultural datasets. The performance measures like RMSE, MAD, MAPE and ME are used to evaluate the model. The results indicated that the performance of the proposed hybrid models are substantially superior as compared to the individual forecasting model.

M.Sc. (Agricultural Statistics)

Name: Vinayaka **Chairman: Dr. Rajender Parsad**

Roll No: 20938

Title of Thesis: Nested Block Designs for Making Test Treatments-Control Treatment(s) Comparisons

Nested block designs are useful for experimental situations in which one nuisance factor is nested within the other nuisance factor, levels of which have been utilized for blocking. The most of nested block designs available in literature is for inferring on all possible elementary treatment contrasts. In agricultural and allied sciences, in many experimental situations, the interest of the experimenter is in comparing a set of new treatments, called test treatments with existing (standard) treatment(s), called control treatment(s). For inferring on elementary contrasts of each of the test treatments with a single control treatment, nested balanced treatment incomplete block (NBTIB) designs available in literature. NBTIB designs may not be available for all parametric combinations or even if available may require large number of replications. To overcome this problem introduced nested partially balanced treatment incomplete block (NPBTIB) designs. Some methods of obtaining NPBTIB designs using the techniques of reinforcement (adding control treatments to existing design in test treatments), and merging of treatments in existing NPBIB designs have been obtained and catalogues of NPBIB designs for $v \leq 16$, $r1 \leq 30$ and $r0 \leq 60$ have been prepared. Further, to deal with the experimental situations, requiring comparison between a set of test treatments and a set of control treatments, nested balanced bipartite block (NBBPB) designs are introduced. Methods of obtaining NBBPB designs have been developed using reinforcement in NBIB designs, merging of treatments in NBIB designs, initial block solutions and writing the blocks of a BBPB design as

NBIB design in number of treatments as block size of BBPB design. Catalogues of NBBPB designs have also been prepared for $v1 \leq 16, v2 = 2, r1 \leq 30$ and $r0 \leq 60$.

Name: Tanima Das **Chairman: Dr. L.M. Bhar**

Roll No: 20939

Title of Thesis: A Study on Volatility Modeling for Agricultural Commodity Prices

Volatility forecasting is an integral part of commodity trading and price analysis. To forecast volatility, Autoregressive Conditional Heteroscedastic (ARCH) model (Engle, 1982) has been introduced to provide better estimate of variance and leading to ultimately better assessment of risk. The drawbacks of ARCH model necessitated the emergence of more parsimonious version *i.e.* GARCH (Generalized ARCH) model (Bollerslev, 1986). As GARCH model cannot capture the asymmetric effect of volatility due to positive and negative shocks Nelson (1991) introduced Exponential GARCH (EGARCH) model followed by the invention of GJR-GARCH model by Glosten, Jagannath and Runkle in 1993. In many literature it has been strongly proved the inefficiency of single parametric model to capture volatility in a series. In this context non-parametric nonlinear model like Support Vector Regression (SVR) may be used to improve forecasting performance. Support Vector Machine (SVM) is a supervised machine learning technique introduced by Vapnik (1992). With some specifications it can be applied in regression problems as well as in time-series analysis. So, in search of an improved alternative to the classical econometric methods, machine learning technique viz. SVR is applied along with its combination with GARCH model. The outperformance of this new approach has also been established by means of Mean Absolute Error (MAE), Root Mean Square Error (RMSE) and R^2 log. Later on for capturing the asymmetric effect of volatility, EGARCH and GJR-GARCH models are fitted on onion price data. This investigation also reveals relative higher efficiency of asymmetric models over GARCH model in capturing asymmetric volatility. Formulae up to two step ahead out-of-sample forecast along with corresponding forecast error variance for EGARCH model have been developed theoretically with recursive use of conditional expectation and conditional variances.

Name: Vinay Kumar L.N. **Chairman: Dr. Tauqueer Ahmad**

Roll No: 20940

Title of Thesis: Resampling based variance estimation for Ranked Set Sampling under Finite Population Frame Work

In experimental settings where actual measurement of an observation is expensive in terms of cost, time and other factors, but ranking a small subset of observations is relatively easy, Ranked Set Sampling (RSS) is cost effective than Simple Random Sampling (SRS) technique. The majority of research in RSS has been concerned with estimating the population mean in the context of infinite population. Estimating the variance in case of Level-0 design of RSS has been found to be cumbersome in the context of finite population. Under this study, three different rescaling bootstrap variance estimation methods viz. Strata based Rescaling Bootstrap With Replacement (SRBWR), Cluster based Rescaling Bootstrap With Replacement (CRBWR) and Unit based Rescaling Bootstrap With Replacement (URBWR) methods have been developed in order to unbiasedly estimate the variance of Level-0 RSS estimator of population mean under finite population framework. The statistical properties of these developed methods have been compared among themselves through a simulation study. The results of the simulation study support that CRBWR method may be preferable to SRBWR method in terms of Percentage Relative Bias (%RB) and SRBWR method performs better than CRBWR method with respect to Relative Stability. The

variance estimation procedure following SRBWR method is the most stable method for unbiased variance estimation of Level-0 RSS estimator. It can also be concluded that we can unbiasedly estimate the variance of Level-0 RSS estimator of population mean and reduce the %RB nearly to zero in proposed methods i.e. CRBWR and SRBWR by using rescaling factors

Name: Debopam Rakshit **Chairman: Dr. B.N. Mandal**

Roll No: 20941

Title of Thesis: Augmented Designs for Mixture Experiments

In mixture experiments, it is assumed that the response is a function of the relative proportions of the ingredients or components in the mixture and the response does not depend on the total amount of the mixture used in the experiment. Augmentation of the design points of the standard simplex-lattice and simplex-centroid designs are needed for better exploration of interior portion of the simplex space. A new method of obtaining more design points by augmenting the design points of simplex-lattice and simplex-centroid designs for mixture experiments with three components is developed in this study. For this purpose, a special property of equilateral triangles is used. From the geometry of triangle, it is known that any equilateral triangle can be partitioned into t_2 equilateral triangles, where t is a positive integer. Simplex space of standard simplex-lattice and simplex-centroid designs are divided into smaller equilateral triangles by this method. The centroid of these smaller equilateral triangles are included in the designs as augmented points. Design evaluation criteria namely D-efficiency per point and G-efficiency of these augmented designs are also studied to evaluate the efficiency of the obtained designs. These efficiencies are compared with previously used designs in agricultural experimentation with same number of design points.

Name: Krishna Pada Sarkar **Chairman: Dr. K.N. Singh**

Roll No: 20942

Title of Thesis: Development of Bayesian Framework for Long Memory Time Series Model.

Time series analysis and forecasting is one of the challenging issues of statistical modelling. Modelling of price and forecasting of agricultural commodities is a vital matter of concern for both the farming community and policy makers. Agricultural commodities are mainly portrayedwith a largedegree of risk with respect to price volatility. Therefore, it is very important to give an accurate forecast of price for better planning and monitoring. Many practical agricultural data, principally commodity price data shows the typical feature of long memory process or long range dependency. For capturing the long memory behavior of the data Autoregressive Fractionally Integrated Moving Average (ARFIMA) model is generally used. In time series data besides the original series, data on some auxiliary or exogenous variables may be available or can be made available with a lower cost; like besides the market prices of commodities, market arrivals for that commodity may be available and it affects the market price of commodities. This type of exogenous variable may be incorporated in existing model to improve the model performance and forecasting accuracy, like Autoregressive Fractionally Integrated Moving Average with exogenous variables (ARFIMAX) model. Generally time series models are fitted using classical approaches like Maximum Likelihood Estimation (MLE) technique, least square estimation technique *etc*. These classical estimation techniques require some assumptions and they only provide the point estimates. These estimates can be improved by applying Bayesian approach using some prior knowledge about the parameters and likelihood function. Keeping these view, Bayesian framework has been proposed for the long memory ARFIMAX model in the present study. The proposed framework has been illustrated using potato maximum price and garlic minimum price using the market arrival as exogenous variable. Posterior distributions of parameters of the model are obtained along with their standard errors. This

study highlights the superiority of Bayesian approach over the classical one in terms of stability of parameters and forecasting efficiency.

Name: Rahul Kumar Gupta **Dr. Arpan Bhowmik**
Roll No. 20943
Title of Thesis: Trend Resistant Block Design under Correlated Error Structure

In agricultural experiment under block design set up, trend effect can affect the plots within block significantly. Thus, trend effect needs to be incorporated in to block model for proper model specification when there are evidences of trend affecting the response. Further, agricultural experiments often witness mutual dependence among plots under block design setup. In the present investigation, experimental setup under block model incorporating systematic trend component when observations are mutually dependent has been defined. The information matrix under such situations has been obtained. The necessary and sufficient condition for a block deign incorporating trend component when observations are correlated have been obtained. Method of constructing efficient trend free block designs have been developed. The characterization properties of such designs have been studied. The performances of the developed designs along with some existing designs from literature have been evaluated in terms of A- and D- efficiency criteria under AR (1) and NN correlation structure. It have been observed the developed designs and also the existing designs evaluated in the present investigation remains highly efficient even for high value of correlation. Comparisons of gain in efficiency per unit between different designs with same number of treatment have been done under different correlation structure and it has been observed that the developed designs generally performs better as compare to the existing designs. For providing readymade solutions to the end users, SAS macros have been developed to generate trend free designs obtained under the present investigation. Catalogue of developed trend free designs for specific parametric combinations have been prepared which will serve as readymade reference to the end users.

Name: Ankita Verma **Chairmen: Dr. Seema Jaggi**

Roll no. : 20944
Title of Thesis: Asymmetrical Response Surface Designs in the Presence of Neighbour Effects

Response surface methodology (RSM) determines and quantifies the relationship between several explanatory variables and one or more measurable response variable(s) and further used in optimization of an underlying process. In agriculture and allied subjects, the treatment combination applied to one experimental plot may affect the response on neighbouring plots as well as the response on the plot to which it is applied. These effects are called neighbour effects and including these effects into the response surface model helps in improving precision of the experiment. In this study, the methodology for asymmetrical response surface designs with neighbour effects has been described, specifically for the situation when there are n factors at two levels each and one factor at three levels i.e. $2^n \cdot 3$. The model considered is a second order model without interaction terms. Conditions have been derived for the near orthogonal estimation of coefficients of response model. Further, conditions for rotatability under these models have also been obtained. A method of constructing asymmetrical response surface designs ($2^n \cdot 3^n$) for fitting second order response surface in the presence of neighbour effects has been described. Particular cases of $2^n \cdot 3^n$ have been discussed. Asymmetrical response surface designs ($2^n \cdot s$) for higher order response surface in the presence of neighbour effects has also been discussed. The designs developed ensure the constancy

of the estimated variance. SAS macros/codes have been developed using PROC IML to generate the designs, compute the variance of parameter estimates and estimated response under second order model incorporating neighbour effects.

Ph.D Computer Application

Name : Chandan Kumar Deb **Guide: Dr. Sudeep Marwaha**

Roll no. : 10272

Title of Thesis: Ontology Learning from Taxonomic Text for Agricultural Knowledge Management

Ontology Learning from Taxonomic text is a novel approach of learning Ontology from semi structured taxonomic text. The traditional ontology learning within the available literature mostly focuses on the ontology learning from the huge corpus of text. The present study mainly concentrates on the ontology learning from the specialized kind of text i.e. the taxonomic text. This study dealt with the exploitation of the typical characteristics of the taxonomic text. The study eventually is subdivided into mainly four broad areas. First, it has developed a text corpus from the taxonomic text of USDA soil taxonomy and enhanced the corpus by the automated scraping of the Wikipedia, with the help of seed word given by the domain experts. After the development of the corpus, the keyword extraction was a challenging task for this research. A heuristic methodology has been developed which is used for the extraction of the keyword. The heuristic method is based on the RAKE guided by the W2V methodology. Second part of the study dealt with the taxonomy induction from the text which contains the core taxonomy. To segregate the core taxonomy part, we have used machine learning techniques for the classification of text. Third part of the study dealt with the taxonomy induction from the non taxonomic part of the text. We have used the hierarchical clustering to induct the taxonomy from the text. Fourth and last part of the work is dealt with the finding of the connections between the taxonomic and non taxonomic class that has been inducted by the second and third part of the work. Several empirical results have been provided and validated using suitable tools and techniques in USDA Soil Taxonomy. Total study involved a wide range of technologies and software. Most of the algorithms are implemented in Python programming language. Some of the experiment involves Java and SQL server. We have also used protégé for the study of existing manually developed ontology.

Name : Tanuj Misra **Guide: Dr. Alka Arora**

Roll no. : 10687

Title of Thesis: Image Analysis Algorithms for High-throughput Phenotyping of Rice and Wheat

Quantification of phenotypic parameter is necessary to meet the future demand of agricultural production. Conventional measurements of these traits/parameters are time-consuming, destructive and labour-intensive. In this study, new approaches have been proposed based on image analysis and machine learning technique to derive phenotypic traits like Leaf Fresh Weight (LFW) in rice plant and spike identification and counting in wheat plant. For this purpose, images have been taken from high-throughput plant phenotyping facility established at Nanaji Deshmukh Plant Phenomics Centre, ICAR-IARI, New Delhi. In this study, it is hypothesized that combined use of visual (VIS) and near infra-red (NIR) image can compute LFW more precisely than VIS image only as NIR reflectance image is used to measure water content of the plant. Two image derived parameters *i.e.*, Green Leaf Proportion (GLP) from VIS image and Mean Gray Intensity (NIR_MGI) from NIR

images have been used for building Artificial Neural Network (ANN) model to estimate LFW. The proposed approach is named as VN_LFW**.** The proposed approach significantly enhanced the fresh biomass prediction as compared with the conventional regression technique in both train and test dataset with Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE) as 0.15 and 9.55 in training dataset and 0.13 and 9.65 in testing dataset respectively. The algorithm of measuring GLP and NIR_MGI has been proposed and the macro has been developed using Matlab software. Another significant area for spike identification has been attempted with deep learning models of Artificial Intelligence. Two models have been developed for spike identification namely **SpikeSegNet** (**S**pike **S**egmentation **N**etwork) and **LGspikeNet** (**L**ocal patch extraction and **G**lobal mask refinement **S**pike detection **N**etwork) based on convolutional encoder-decoder deep learning technique. For counting number of spikes per plant, *"analyse particles"* function of imageJ which implements flood-fill image analysis technique has been applied on the output image (binary/mask image containing spike regions only) of the developed model. For spike identification, precision, accuracy and robustness (F_1 score) of the proposed **SpikeSegNet** model has been found as 94.56, 94.66 and 94.88% respectively whereas for **LGspikeNet** it has been as 99.95, 99.96 and 99.96% respectively. In spike counting using **LGspikeNet,** the metric values are 99, 94 and 92% respectively. Online software for identification and counting of wheat spikes has also been developed by using the proposed **LG*spike*Net** network model.

Name : Sreekumar Biswas **Guide : Dr. Rajni Jain**

Roll no. : 10273

Title of Thesis: Document Categorization Using Text mining in Agricultural domain

The World Wide Web (WWW) is a source of vast amount of information. Today, many researchers are dependent to WWW to carry out research to a large extent. Most of the scientific journals are available online for various domains. Agriculture is one of the sectors of research that is gradually growing interest among the researchers at a high pace. Agriculture, being a sector, which provides as high as 17-18 per cent GDP to the Indian economy and providing more than 60 per cent of the employment of the country, it is obvious reason for this increasing interest of the researchers. ICAR-IARI is an institute which publish plenty amount of research articles in various journals per year. Some of the articles are inter-disciplinary in nature, i.e., these researches are a combination of two or even more than two principles of disciplines. For example, research papers that are a combination of two disciplines such that social science research papers related to crop science. Where to find them? Whether in crop science journal or in social science journal? Or agricultural engineering research papers related to crop science. Whether in crop science journal or in social science journal? Our aim is to categorize the research documents in agricultural domain. Thus, these knowledge bases, in form of journals are unstructured. Machine learning, in more appropriate terms, text categorization using machine learning is a way out. We collected data for this research from Prof. M. S. Swaminathan Library, ICAR-IARI, New Delhi. Data consists of the titles and abstracts of different articles in plain text (.txt) format. Collected data was unstructured in nature which has represented in to a suitable machine readable format using pre-processing as described by the KDD process to smooth the path for the knowledge discovery process, we have used classifier subset evaluator and wrapper subset evaluator approach for feature selection. To adjudge the best method for feature selection, experiment is repeated 100 times using 10X10 Cross Validation. After feature selection applied some recognized text categorization algorithms to develop models for categorization. The categorization algorithms used were J48, KNN, Random Forest, Naïve Bayes, SVM and MLP, ZeroR and OneR, where ZeroR and OneR used as baseline algorithm.

To customise these algorithms for the work in this thesis Java and R languages are used along with the standard algorithms related to text mining from WEKA 3.8, NetBeans IDE 8.0.2 and R 3.3.2. Text categorization was attempted using three scenarios on the text data collected for the purpose. In the first phase, it was attempted on titles of the research documents. The hypothesis was that titles represent the document in most relevant words so they should also be able to categorise the documents with acceptable accuracy which should be higher than the probability of that category. We observed Naïve Bayes algorithm have highest accuracy of 78.77% using titles only. In second phase, experiment was performed by using abstracts of all the document in the corpus. The hypothesis was improvement in the categorisation results because of inclusion of more relevant text in the document. The results showed that accuracy improved with abstracts. We observed highest accuracy of 96.69% using Naïve Bayes algorithm in this scenario. In, third scenario, experiment was done by taking titles with abstracts so as to add more relevant knowledge to the model. The results showed highest accuracy of 93.41% using Random Forest algorithm in this scenario.

To estimate the average accuracy, 10X10 Cross Validation was used in all scenarios using all the algorithms. The performance of the models were compared statistically and the best model was selected. MLP algorithms with CSNB (Classifier subset evaluation with Naïve Bayes as parameter algorithm) for feature selection perfumed best on agricultural text documents (abstracts inclusive titles) for categorising them with 90 per cent accuracy. In future, it is possible to improve this accuracy by more advanced techniques like deep learning. Further, in future attempts will be made to categorise by using various other combinations of texts like abstracts with conclusion and abstracts with results and so on.

M.Sc. (Computer Application)

Name: Abhishek M.P. **Guide: Dr. Mukesh Kumar**
Roll No.: 20959
Title of Thesis: Mobile Based decision Support System for postural Assessment of agricultural activities using Rapid upper limb Assessment (RULA) technique

Agricultural workers, especially rural people suffer from musculoskeletal disorders (MSDs) in different parts of the body, especially low and upper back pain, during different agricultural activities. The causes of MSDs in agriculture is result of heavy burden, repetitive motion, awkward working postures, long time working in neo neutral and unsupported positions and use of non-ergonomically designed traditional tools and implements. Ergonomic risk factors involved in working environment can be measured by using various assessment tools to determine the worker's capabilities and limitations. The work-related risks can be measured directly by using some of the scientifically proven postural assessment tools like RULA, REBA etc. Standard assessment worksheets or tables are used to evaluate the working posture during each operations or activities.
RULA is a method designed to provide a quick analysis of the demands on a person's upper limb. It provided an objective measure of the MSDs risk caused by tasks where the demands on the upper body are high RULA technique is primarily assessed the upper limb (hand, wrist, elbow, shoulder), but also the neck and low back (due to trunk postures). DSSs serve the management, operations and planning levels of an organization (usually mid and higher management) and help people make decisions about problems that may be rapidly changing and not easily specified in advance. Decision support systems can be either fully computerized or human-powered, or a combination of both.

Several DSS have been developed in different agricultural activities but there is no such system available for postural assessment technique of work-related musculoskeletal disorder. It is in this context, the development of DSS is being proposed for postural assessment of agricultural activities with Rapid Upper Limb Assessment (RULA) technique which available online so that wherever, whenever the farmer or evaluator needs any information can interact with this system and retrieves any

information related to his or her work that is going to be performed in easy way. By this assessment technique posture can be evaluated and farmers may be suggested /recommended the correct posture to avoid developing musculoskeletal disorders.

Name: Amit Saha **Guide: Dr. Md. Samir Farooqi**
Roll No.20960

Title of Thesis: A prototype software for Agriculture supply chain using Block chain technology: case study of Rice

Supply Chain is a way to document and streamline all the activities in the distribution chain in order to ensure the constant supply of quality product to the customer. It emphasizes in improving the performance of the delivery of assured, safe, desirable and good quality end product to the consumer in a cost effective manner. Now a days, a reliable supply chain model has become very essential to deal with the present market scenario. The complexity of interlacing supply chain networks with growing market size is a matter of concern. Moreover this increase in complexity and fluctuating prices of commodities and their availability to the consumers. This problems can be tackled with the application of blockchain technology as the basic structure to implement a supply chain network. It helps in increasing the visibility of the product distribution to the various stakeholders of the network. Existing supply chain systems are lacking the ability to transmit ground level information in transparent manner to all stakeholders of the network. These are also vulnerable in case of proving authenticity and validity of the commodity. At the same time transparency, scalability and security of the present supply chains are big concern with the growing interlacing markets. This thesis describes a solution that can be used to address the above mentioned concerns and bring the transparency in the supply chain network. This solution provides a platform through which small, medium and large business enterprises and customers can interact with each other in a dynamic and transparent manner. The developed software prototype contains a private blockchain using shared ledger that stores the transfer of assets held by various stakeholders. All the information about the products and the shipments are submitted in this shared ledger by the verified stakeholders of the network. By using this blockchain based supply chain software prototype, it provides a secure, incorruptible and immutable way to record and share the information among various stakeholders.

Name: B. Jagdish Naik **Guide: Dr. S.B. Lal**
Roll No.20962
Title of Thesis: Development of mobile app for locating nearby mandis and price forecast of selected Agricultural commodities

In last few years, tremendous improvement has been seen in the field of mobile technology. This enhancement has made the smartphones and mobile apps, an integral part of human life. These days, the smartphones and mobile apps have made remarkable changes in all sectors of the Indian economy. The mobile apps are being used everywhere from highly developed cosmopolitan cities to the rural villages. In this study, an attempt has been made to develop a mobile application named ‘Mandi Info’ for the India farmers. This mobile application is aimed to provide timely and valid Mandi information to the farmers about prices of the commodities that prevail in the nearby markets. This app can also help the farmers in providing the forecasted prices of the commodities. The farmers are able to check the prices of the commodities in the markets of all over India and can this share data with others in the form of pdf file. In this thesis, the ‘Mandi Info’ app has been developed on the android platform with minimum SDK version of API 21: Android 5 (Lollipop). The application is based on the 3-tier architecture of the software development. The client-side interface is the android application itself which is implemented by the JAVA programming language and XML. The next layer is a database layer. The database layer contains the data of AGMARKNET portal. APIs from data.gov.in, AGMARKNET and Google places API has been

used for interconnection among various layers. The application has been tested with the help of API from AGMARKNET and provided the intended results as specified. The developed android application 'Mandi Info' would be of great use to the farmers to deal with current commodities prices like maximum, minimum and modal prices in the market and forecasted prices.

Name: Rohit Kumar Singh **Guide: Dr. Shashi Dahiya**
Roll No.20963
Title of Thesis: Mobile base Decision support system for crop selection using economic criteria

Agriculture is one of the important contributors to the Indian economy. Best utilization of the resources is always good for Indian agriculture. Taking the high crop returns depends on several factors like soil condition, climatic condition, rainfall, selection of suitable and optimum amount of the input materials etc. All of these factors contribute to good output. The farmers are always in dilemma about which crop to be grown and what inputs need to be given in their specific area. They also don't know what would be the possible return and the maximum profit from that crop. There are a number of mobile apps developed for various agricultural issues, still, there is a need for an application that can guide a farmer to make decision about their crops. The mobile app named "Mobile based Decision Support System for Crop Selection" is a decision support system for the Haryana state farmer to select their crop for maximum output. It also advises the farmers about the inputs to be applied and what will be the approximate output and profitability from that crop. The Decision Support System for Crop Selection has been developed on Android Studio 2.3.x. The minimum requirement for the app is a device running on API 15: Android 4.0.3 (IceCreamSandwich). Programming language used to develop DSS for crop selection is Java and Xml. Tools used to develop the app are SQLite, Android Studio IDE, Android Device Monitor, and Mozilla Firefox. The app provides an easy interface to the user which help the farmer to make the decision about their crop, it also provides the information about the right quantity of inputs to be applied to the crop. The DSS also provides the information about the output of the main product and returns from the by-product and main product.

Name : Lishi Kumari **Guide : Dr. Sangeeta Ahuja**

Roll no. : 20964

Title of Thesis: Study on development of mobile app on Anthropometric dimensions of agricultural workers for designing and assessing farm tools and machineries

Anthropometric body dimensions play a significant role in human-machine interaction. The overall working efficiency of human-machine environment and resultant discomfort has severe impact while using farm tools and machinery in agricultural fields. A large proportion of the workforce in the world is involved in agriculture or related occupations. In India, about 300 million workers are associated with farm work constituting one fifth of the world's agricultural work force. An estimated 77.6% of all incidents were due to farm machinery, 11.8% were due to hand tools, and the remaining 10.6% were due to other factors. It has been reviewed that hand injury statistics from literature and inferred that hand tools cause 9 of all reported disabling injuries, and 75% are because of manual tools. Hand tool constitutes significant number (58%) in farm injuries, involving a very high number of farm workers (65%). This thesis presents the anthropometric data of agricultural workers in order to obtain information of the body dimensions, which can be used in design of farm equipments or to improve farm tools ergonomically. Forty five different structural body dimensions and four strength parameters are identified and the measurement was conducted. The data to be measure statistically analyzed for mean, standard deviation and percentile values which are used in design. Measured and calculated anthropometric data of agricultural workers could be useful in design and modification of farm implements which would reduce drudgery and discomfortness of farm worker and enhance the efficiency. The thesis is based on modification in tools in reference to descriptors associated with comfort, safety and functionality. The information in this research will be useful for anthropometric

assessment tools and the modification of hand tools, personal protective equipment, workstations and interface systems imported into agricultural workers to reduce human error and improve public health. The inclusion of anthropometric data helps ensure that devices or machines are safe, user-friendly and highly productive and efficient. In this thesis, the "ANTHRO" app is developed using Android Studio 3.3.2 and the minimum requirement for the app is a device running on API 16: Android 4.1 (Jelly Bean). The application is based on three-tier architecture of the software development. The client-side layer is the android application itself which is implemented by the JAVA Programming language and XML. The server application layer contains core classes like database connection, the connection between other layers. The database layer consists of the data of anthropometric dimensions of agricultural workers related to the designing ergonomically sound farm machineries and equipments. The mobile app has been tested for the various agricultural activities in field and provides the given results. This android app "Anthro" would be of great use to the farmers/ user for reducing drudgery during farm activity. The user can also utilize information about all anthropometric measurements of agricultural workers in one go. The app would be very much useful for agriculture.

Lovkush Patel **Guide : Dr. Md. Samir Farooqi**

Roll No. : 20806

Title of Thesis: Trait Associated Gene Selection from expression

To identify the informative genes from high throughput expression data is a challenging task. Several R packages are available for selection of informative genes, which are error prone in terms of occurrences of false positive and false negative but there is dependency of knowing R programming to operate these packages. So there is need for user friendly web based platform which integrate the outcomes obtained from different R packages and give biologically more consistent results. Web based software for gene selection TAGexp has been developed by integrating R package GSAQ to perform gene Selection from expression data. Development work has been carried out using technologies like Java Server Pages (JSP), Hyper Text Markup Language (HTML), Java Script, Cascading Style Sheets (CSS) for front end interface, SQL for backend database and R has been used for integration with JSP to display the results in developed web based interface for gene selection. The developed interface shows the gene IDs of the informative genes, which are significantly identified from, integrated procedure of gene selection. These informative genes can be useful for further genomic study with less computational resources.

Ph.D Bioinformatics

Name: Sayanti Guha Majumdar **Guide: Dr. Anil Rai**
Roll No. 10429
Title of Thesis: Development of Integrated Model for Genomic Selection

Genomic Selection (GS) is a recent area for efficient breeding of animals and plants. GS has been used globally for increasing agricultural production and productivity in recent days. It is suitable for selecting complex quantitative traits which lead to the efficient selection of breeding material after predicting Genomic Estimated Breeding Values (GEBVs) of target species. The accuracy of estimation of GEBVs depends on a large number of factors which include training population, genetic architecture of target species, statistical models, etc. Accuracy of selection of breeding parents also varies based on selected GS models according to their assumptions and treatments of marker effects. The first step of GS is feature (marker) selection. There are several models available in the literature for selection features in GS. However, applicability of these models is based on many factors including extent of additive and epistatic effects of breeding population. Therefore, there is strong need to evaluate the performance of these models and techniques of feature selection under different genetic architecture. Furthermore, statistical models for Genomic Selection available for estimation of Genomic Estimated Breeding Value are not robust against this genetic architecture

and depend on datasets. Some models perform well for additive genetic architecture and others perform well for non-additive genetic architecture. But, there is lack of estimator which could capture both of these effects simultaneously. Therefore, this study has been conducted to develop a robust estimator which may be able to capture both additive and non-additive effects efficiently. First, the performance of linear/ additive effect models as well as non-linear/epistatic effect models have been evaluated through a simulation study. In general, performance of SpAM was found to be superior for GS than all other additive effects models considered in this study. However, in case of low heritability and high epistatic effect, the HSIC LASSO out performed all competitive models. Therefore, arobust integrated estimator has been developed by combining these two efficient additive and non-additive models i.e. SpAM and HSIC LASSO respectively. Further, for estimation of error variance four different methods have been evaluated which are being used for estimation of weight in the developed Integrated Model. The performance of the proposed model has been evaluated on the basis of prediction accuracy, fraction of correctly selected features and redundancy rate along with their standard error of mean. Further, the performance of the proposed model has been compared with SpAM and HSIC LASSO with respect to the above criteria. The newly developed estimator is found to be superior in terms of its performance and it has been demonstrated to be robust against any genetic architecture of datasets. Also the performance of the developed Integrated Model has been evaluated in case of 2%, 5% and 10% genotypic imputation of data and it is found to be comparable with respect to the complete dataset.

M.Sc. Bioinformatics

Name: Nitesh Kumar Sharma
Roll No. 20954 **Guide: Dr. D.C. Mishra**

Title of Thesis :Some Investigation on Selection of Informative Genes using Gene Expression Data

Informative gene selection from high dimensional gene expression data has appeared as an important area of research in agri-genomics. Different gene selection techniques has been developed in recent time based on relevancy and redundancy of genes with class and among the genes. Most popular techniques for informative gene selection are Maximum Relevancy and Minimum Redundancy (MRMR) and Support Vector Machine Recursive Feature Elimination (SVM-RFE). However, these methodology have some drawbacks. One of the major drawback is that it ignores the spurious relations between genes and trait under study. In this study, a methodology for informative gene selection has been developed which takes care of this spurious relation by implementing the bootstrap technique along with SVM-RFE and MRMR.

The performance of these gene selection techniques has been analyzed through classification accuracy of the SVM model with linear kernel developed using selected informative genes as predictors. A comparative evaluation of the developed method was done against three well known existing techniques for gene selection viz. Boot-MRMR, SVM-RFE, MRMR. On the basis of various evaluation measures, it has been observed that the performance of the developed methodology is better as compared to above given techniques and select less number of more informative genes.

In order to proper implementation and dissemination of the developed methodology, a user friendly web-based tool named "Informative Gene Selection Tool (IGST)" has been developed by using state of the art technology. This study will provide a practical guide to select informative genes from high dimensional expression data to enhance the molecular breeding program in the area of agriculture science.

Name: Naveen Kumar H.S. **Guide: Dr. Monendra Grover**
Roll No. 20955
Title of Thesis: Prediction and Analysis of abiotic Stress Responsive IncRNAs in lens culinaris

Lentil (*Lens culinaris*) an annual, bushy in nature known for its 'lens-shaped seeds' belonging to the family *Leguminaceae* , It is famous as poor man's nourishment also commonly known as masoor dal, dal etc. It is 40 cm tall and the diploid plant (2n = 2 = 14) with a genome size of 4 Gbp. It has the ability to fix air nitrogen, which makes it very important in soil health and wealth management. . It is well known for having seeds formed at its focal point. The crop production in Lentil is affected by both biotic as well as abiotic factors. Drought and Heat stress are the major environmental stresses affecting plants, resulting in reduced productivity and crop losses.The present study is based on the paired-end reads of control and drought affected leaf transcriptome of Lentils in both drought and heat stress condition generated by Illumina Hiseq 2000 technology. The study aims at identification of long non-coding RNAs in leaf tissues of Lentils for both drought stress and Heat stress by its transcriptional profiling, Target prediction of these lncRNAs and their regulating function in this crop are very much lagging. *De novo* transcriptome assembly was carried out using the assembler trinity. A total of 112210 transcripts, 2,155 lncRNAs and 177 differential expressed lncRNAs seen in Drought stress where as in heat stress a total of 106723 transcripts , 3447 lncRNAs with no differential expression were seen. .mi-RNAs like miR6167, miR1134, miR1134 are found to interact with the putative lncRNAs. All this information can be further be utilized in the implementation of genetic improvement by designing markers and validation for

development of new improved cultivars. The target prediction of lncRNAs can also be valuable genomic resource in endeavour of drought and heat tolerant variety development for higher productivity of Lentil.

Name: Tanway Dasmandal **Guide: Dr. A.R. Rao**
Roll No. 20956
Title of Thesis : Identification and Characterization of circular RNAS in Legumes

Leguminous crops are important crops next to cereals. The production and productivity of these crops has a major impact on country's economy as well as the economic status of the stakeholders-farmers. Moreover, the nutritional security can be ensured through growing of these leguminous crops. In this context, two leguminous crops, chickpea and soybean along with their transcriptome data were considered in the present study. With the advent of NGS technologies it has become feasible to unravel the underlying complex mechanisms at genome level. Even though the coding genes play a major role in various abiotic and biotic stress mechanisms, there are several non-coding RNAs which regulate the genes responsible for stress tolerance mechanisms. However, the identification and characterization of circular RNAs, a type of non-coding RNAs as well as the circRNA-miRNA-mRNA networks in legumes has not been fully explored. Hence, the present study on 'Identification and characterization of circular RNAs in legumes' has been taken up with the objectives: (i) to identify and characterize circRNAs responsible for biotic and abiotic stress tolerance in the leguminous crops and (ii) to study the relationship between circRNA-miRNA-mRNA. Here the transcriptome data of the said crops were collected from public domain (NCBI, Ensemble, etc) and the algorithm given in CIRI (CircRNA Identifier) was used to identify the circRNAs under drought (abiotic) and wilt (biotic) stress conditions. The characterization of circRNAs was done through their differential expression in both drought and wilt stress conditions. The differentially expressed (DE) circRNAs were further probed for their role in circRNA-miRNA-mRNA interaction. Finally, the identified genes from the network were studied for their functionality in stress tolerance mechanisms. The results revealed identification of 200 and 285 circRNAs under control and drought stress conditions in chickpea, 57 and 66 circRNAs under control and drought stress conditions in soybean and 48 and 75 circRNAs under control and wilt stress conditions in soybean. The number of DEcircRNAs were 44, 23 and 24 in chickpea-drought, soybean-drought and soybean-wilt respectively. These DEcircRNAs were found to act as sponges for 40 (chickpea-drought), 17 (soybean-drought) and 10 (soybean-wilt) miRNAs. Besides, these miRNAs were found to target 145 (chickpea-drought), 281 (soybean-drought) and 275 (soybean-wilt) mRNAs. GO study was carried out for the mRNAs and found that they are involved in biological processes like 'metabolic process' and 'cellular process', molecular functions like 'binding' and 'catalytic activities' and cellular components like 'cell', 'cell part' and 'membrane part'. Thus circRNA-miRNA-mRNA network play a vital role in stress responsive mechanisms through their activities in hormone signal transduction, response to stress, response to auxin and transcription factor activity.

Name: Baibhav Kumar **Guide: Dr. Sarika**
Roll No. 20957
Title of Thesis : Identification of Drought Responsive Long Non-Coding RNAs in Pearl Millet

Pearl millet, scientifically named *Pennisetum glaucum* L. (2n=14) is an annual C4 grass of family *poaceae* and sub-family *panicoideae*. It is also known as bajra, cattail millet, bulrush millet and dark millet. Pearl millet is the world's 5th most important cereal crop and mostly grown by the poor and marginal farmers in arid and semi-arid tropics of Asia and Africa, due to its less intensive agronomic practices like less fertilizers and limited irrigation input. Pearl millet is cultivated mainly for its grains but also used as feed material for cattle, poultry, fish etc. Pearl millet crop is able to

perform well in drought conditions where most of the cereals like wheat, rice and maize fails. So, understanding the molecular mechanism of the responses of pearl millet to adverse conditions is important. Key candidate genes controlling drought response in Indian pearl millet have been discovered and reported but lncRNA still remains uncovered. Expression of candidate genes are controlled by microRNA, TFs and lncRNA. The study aims at identification of drought responsive lncRNAs and development of a web genomic resource for user friendly access of the investigation findings, which is otherwise lacking in this crop. A total of 879 lncRNAs were identified out of which 209 (leaf control, leaf treated), 198 (leaf treated, root treated), 115 (leaf control, leaf treated) and 194 (root control, root treated) were differentially expressed. Two lncRNAs were found as potential target mimics of 3 miRNAs from the miRBase database. Gene ontology study was carried out which revealed that drought responsive lncRNAs are involved in biological processes like 'metabolic process' and 'cellular process', molecular functions like 'binding' and 'catalytic activities' and cellular components like 'cell', 'cell part' and 'membrane part'. LncRNA-miRNA-mRNA network play a vital role in stress responsive mechanisms through their activities in hormone signal transduction, response to stress, response to auxin and transcription factor activity. Only four lncRNAs were found to get a match with the lncRNAs present in plant lncRNA database CANTATAdb, which shows its poor conserved nature among species. All these information have been catalogued in pearl millet drought responsive long non-coding RNA database (*PMDlncRDB*) accessible freely at https://webtom.cabgrid.res.in/pmdlncrdb. The information from *PMDlncRDB* can be used for pearl millet improvement program in endeavour of higher production, combating drought in pearl millet.

Name: Jutan Das **Guide: Sh. Sanjeev Kumar**

Roll No. 20958

Title of Thesis : Computational Intelligence in the estimation of CRISPR Cas9 cleavage sites

CRISPR-Cas9 system is one of the most significance genome editing techniques in the recent time period because of its higher potentiality to modify the specific target genes and region of the genome which are complementary of the designed guide RNA (or sgRNA). Based on the target sequence different sgRNA was design for accurately manipulating the desired genomic sites. CRISPR-Cas9 still now suffering from the off-target effect. Here, I developed three machine learning based techniques (i.e. Artificial Neural Network, Support Vector Machine and Random Forest) for estimation of the CRISPR-Cas9 cleavage sites to be cleaved by a given sgRNA. All of these machine learning model are developed based on the plant dataset which are overlooked in previous studies. The models were train and tested on the collected on-target and off-target dataset of different plant species. For ANNs I developed total six models (ANN1-Logistic, ANN1-Tanh, ANN1-ReLU, ANN2-Logistic, ANN2-Tanh, and ANN-ReLU) among all of these model ANN1-ReLU model give the best result from other ANN based developed models. Here, I developed total four SVM model (SVM-Linear, SVM-Polynomial, SVM-Gaussian and SVM-Sigmoid), from all the model SVM-Linear model performance better compare to other three developed model. I demonstrate that random forest model attains the best performance on the plant dataset among other developed models, its produce an average classification area under the ROC curve (AUC) is 99.0%. Also I display that the prediction by my developed models are more precise compare to other available methodologies (CRISTA). Additional analyses are led to explore the fundamental reasons from different perceptions.

6. AWARDS TO STUDENTS

- Mr. Krishna Pada Sarkar (Agricultural Statistics)

- Received Nehru Memorial Gold Medal 2020 of IASRI for being Best M.Sc. (Agricultural Statistics) Student during the Annual Day of the Institute

- Mr. Abhishek MP (Computer Application)
  - Received Nehru Memorial Gold Medal 2020 of IASRI for being Best M.Sc. (Computer Application) Student during the Annual Day of the Institute
- Ms.Tanwy Dasmandal (Bioinformatics)
  - Received Nehru Memorial Gold Medal 2020 of IASRI for being Best M.Sc. (Bioinformatics) Student during the Annual Day of the Institute
- Mr. Amit Saha (Agricultural Statistics)
  - Received M.K. Bose award for best Ph.D.(Agricultural Statistics) student for the session 2016-19 during the Annual Day of the Institute

7. ANNUAL DAY CELEBRATIONS

The Annual Day of the Institute was celebrated on July 02, 2020 in which Dr. DVV Ramana, Professor, Preventive Medicine, Health and Biomedical Informatics Division, Feinberg School of Medicine, Northwestern University, USA delivered the Nehru Memorial Lecture entitled "Statistical Pattern Recognition and Machine Learning Applications in Life Science Research". Dr. R.C. Agrawal, DDG (Education), ICAR presided over the function. Dr. Trilochan Mohapatra, Secretary, DARE & DG, ICAR was the Chief Guest.

8. TEACHER'S DAY CELEBRATIONS

The Teacher's Day was celebrated on September 05, 2020 in which Dr. R. C. Agrawal, DDG (Education) delivered lecture on the topic of New National Education Policy.

9. RESEARCH FELLOWSHIPS

During 2020-21, 61 Ph.D. and 37 M.Sc. students received research fellowship. 42 Ph.D. students received IASRI fellowship @ Rs.31,000/-(First and Second Year), 35,000/- (Third Year) per month in addition to Rs.10,000/- per annum as the contingency grant. 02 Ph.D. student received Rajeev Gandhi National Fellowship @31,000/-, 01 Ph.D. student received DBT Scholarship @ Rs.31,000/- per month, 01 student received ICMR fellowship @ Rs. 31,000/- in addition to Rs.20,000/- per annum as contingency Grant. 07 Ph.D. students received UGC fellowship @ 31,000/- per month and Contingency Rs.10,000/-, 04 students received Maulana Azad National Fellowship @ Rs.31,000/- per month and Rs.10,000 per annum as contingency grant. 12 M.Sc. students received ICAR Junior Research Fellowship @ Rs.12,640/- per month in addition to Rs.6,000/- per annum as contingency grant and 25 M.Sc. students received IASRI fellowship @ Rs.7,560/- per month and Rs.6,000/- per annum as contingency grant.

Courses taught in the academic session 2020 (Agricultural Statistics)

Code	Course Title	Credits		Course Instructors
		L	P	
Trimester – II (2019-20)				
PGS 504	Basic Statistical Methods in Agriculture	2	1	Arpan Bhowmik, Himadri Shekhar Roy, Pradip Basak
AS 502	Basic Design of Experiments	2	1	Susheel Kr. Sarkar, Sukanta Dash, Anil Kumar
AS 551	Mathematical Methods in Statistics	4	0	Cini Varghese, Himadri Ghosh Sukanta Dash,

AS 562	Advanced Statistical Methods	2	1	Seema Jaggi, Ranjit Kumar Paul, Arpan Bhowmik
AS 565	Sampling Techniques	3	1	Tauqueer Ahmad, Prachi Misra Sahoo, Kaustav Aditya, Ankur Biswas
AS 570	Statistical Modeling	2	1	Ranjit Kumar Paul, Achal Lama, Mrinmoy Roy
AS 573	Demography	2	0	Prawin Arya, Wasi Alam, Anuja A.R.
AS 574	Advanced Data Analysis Using Statistical Software	1	2	B.N. Mandal, Rajender Parsad, Hukum Chandra, Ankur Biswas
AS 605	Advanced Statistical Inference	1	1	K.N. Singh, L.M. Bhar, Kaustav Aditya
AS 607	Stochastic Processe	3	0	Himadri Ghosh, Ramasubramanian V., Soumen Pal
AS 661	Advanced Designs for Single Factor Experiments	2	1	Cini Varghese, B.N. Mandal, Seema Jaggi
AS 663	Advanced Theory of Sample Surveys	2	1	Tauqueer Ahmad, Hukum Chandra, Ankur Biswas
AS 665	Advanced Statistical Methods for Population Genetics	2	1	A.K. Paul, L.M. Bhar
AS 691	Seminar	1	0	Ramasubramanian V.
Trimester - III (2019-20)				
PGS 504	Basic Statistical Methods in Agriculture	2	1	Sarika, Ajit, Anindita Datta
AS 503	Basic Sampling and Non-parametric Methods	2	1	Kaustav Aditya, Ankur Biswas, Raju Kumar
AS 563	Statistical Inference	4	1	K.N. Singh, Arpan Bhowmik, Pradip Basak
AS 564	Design of Experiments	3	1	Seema Jaggi, B.N. Mandal, Anindita Datta
AS 566	Statistical Genetics	3	1	L.M. Bhar, A.K. Paul, Himadri Shekhar Roy
AS 662	Advanced Designs for Multi-factor Experiments	2	1	Rajender Parsad, Sukanta Dash
AS 664	Inferential Aspects of Survey Sampling and Analysis of Survey Data	2	1	Hukum Chandra, Kaustav Aditya, Vandita Kumari
AS 666	Advanced Quantitative Genetics	2	1	A.R Rao, Prabina Kumar Meher
AS 667	Forecasting Techniques	1	1	Ramasubramanian V., Achal Lama, Amrender Kumar
AS 668	Bayesian Inference in Survey Sampling	1	1	Hukum Chandra, Pradip Basak
AS 691	Seminar	1	0	Prawin Arya

Trimester-I (2020-21)				
PGS 504	Basic Statistical Methods in Agriculture	2	1	Susheel Kr. Sarkar, Wasi Alam, Raju Kumar
AS 501	Basic Statistical Methods	2	1	Mir Asif Iquebal Mrinmoy Ray, Vandita Kumari,
AS 567	Applied Multivariate Analysis	2	1	Rajender Parsad, Arpan Bhowmik, Prabina Kumar Meher
AS 568	Econometrics	2	1	G.K. Jha, Achal Lama Kanchan Sinha
AS 569	Planning of Surveys/ Experiments	2	1	Tauqueer Ahmad, Prachi Misra Sahoo, Ajit
AS 572	Statistical Quality Control	2	0	Prawin Arya, Wasi Alam
AS 600	Advanced Design of Experiments	1	1	Rajender Parsad, Cini Varghese
AS 601	Advanced Sampling Techniques	1	1	Hukum Chandra Prachi Misra Sahoo Pradip Basak
AS 603	Regression Analysis	1	1	Ranjit Kumar Paul, Kanchan Sinha
AS 606	Optimization Techniques	1	1	B.N. Mandal, Achal Lama, Harish Kumar H.V.
AS 691	Seminar	1	0	Kanchan Sinha

Course taught Semester-wise 2020-21

Course Code	Course Name	Credit-L	Credit-P	Course Instructors
SEMESTER I				
STAT 501	Mathematical Methods For Applied Sciences	2	0	Susheel Kumar Sarkar, Raju Kumar, Pankaj Das
STAT 511	Statistical Methods For Applied Sciences	3	1	M.A. Iquebal, Vandita Kumari, Himadri Shekhar Roy, Bharti

STAT 531	Data Analysis Using Statistical Packages	2	1	Sukanta Dash,Ankur Biswas, Ajit,Rajender Parsad
STAT 551	Mathematical Methods – I	3	0	Himadri Ghosh, Cini Varghese, Sukanta Dash, Raju Kumar
STAT 552	Mathematical Methods – Ii	2	0	Cini Varghese, Himadri Ghosh, Mohd Harun
STAT 560	Probability Theory	2	0	K.N. Singh, Anindita Datta, Rahul Banerjee
STAT 561	Statistical Methods	2	1	Seema Jaggi, Ranjit Kumar Paul, Arpan Bhowmik
STAT 567	Regression Analysis	1	1	Ranjit Kumar Paul, Ramasubramanian V., Md. Wasi Alam,
STAT 571	Bioinformatics	2	0	Sarika, M.A. Iquebal
STAT 574	Optimization Techniques	1	1	B.N. Mandal, Amrender Kumar, Anuja A.R, Harish Kumar H.V.
STAT 575	Demography	2	0	Prawin Arya, Shivaswamy G.P, Rajesh. T.
STAT 591	Master's Seminar	1	0	Kanchan Sinha
STAT 599	Master's Research	10	0	
STAT 602	Simulation Techniques	1	1	Tauqueer Ahmad, Mrinmoy Ray, Anil Rai
STAT 613	Advanced Design Of Experiments	2	0	Rajender Parsad, Cini Varghese, B.N. Mandal
STAT 614	Advanced Sampling Techniques	2	0	Hukum Chandra, Kaustav Aditya, Vandita Kumari
STAT 615	Advanced Statistical Genetics	2	0	A.K. Paul, Samrendra Das, Prabina Kumar Meher, Himadri Shekhar Roy
STAT 616	Statistical Modeling	1	1	Ranjit Kumar Paul, Achal Lama, Mrinmoy Ray
STAT 691	Doctoral Seminar I	1	0	Kanchan Sinha
STAT 699	Doctoral Research	45	0	

Course taught in the academic session 2020 (Computer Application)

Code	Course Title (L + P)	Credits L	Credits P	Instructors
Trimester II (2019-20)				
CA 501	Computer Fundamentals and Programming	3	2	Ajit, Pal Singh
CA 562	Object Oriented Analysis and Design	2	1	Sangeeta Ahuja, Sudeep Marwaha

CA 564	Data Structures and Algorithms	2	1	Shashi Dahiya, A.R. Rao
CA 566/ BI 507	Data Base Management System	2	2	S.B. Lal, Anu Sharma, Soumen Pal
CA 568	Software Engineering	2	0	A.K. Choubey
CA 572	GIS and Remote Sensing Techniques	2	1	Anshu Bhardwaj, Rajni Jain
CA 573	Data Warehousing	2	1	K.K. Chaturvedi, Md. Samir Farooqui
CA 574	Multimedia and Applications	1	1	Sangeeta Ahuja, Sudeep Marwaha
CA 577	Data Mining and Soft Computing	2	1	Shashi Dahiya, A.K. Choubey, Anshu Bhardwaj,
CA 578	Information Security	2	1	Mukesh Kumar, Md. Samir Farooqi
CA 580	Mobile Application Development	1	1	S.B. Lal, Soumen Pal
CA 617	Natural Language Processing	1	1	Anu Sharma, K.K. Chaturvedi
CA 691	Seminar	1	0	S.N. Islam
Trimester III (2019-20)				
CA 503	Statistical Computing in Agriculture	1	2	Rajender Parsad, Ramasubramanian V., Wasi Alam Ranjit Kumar Paul
CA 563	Operating System	2	1	Soumen Pal, Shashi Dahiya
CA 567	Computer Networks	2	1	S.N. Islam, Mukesh Kumar
CA 571	Modeling and Simulation	2	1	Wasi Alam, Ankur Biswas, Vandita Kumari
CA 613	Artificial Neural Networks	2	1	Ramasubramanian V., Mrinmoy Ray, Achal Lama
CA 615	Digital Image Processing	2	1	Alka Arora, Prachi Misra Sahoo
CA 691	Seminar	1	0	Pal Singh
Trimester I (2020-21)				
CA502	Introduction to Computer Application	1	1	Ajit, Md. Samir Farooqi
CA 552	Computer Oriented Numerical Methods	2	1	A.K. Choubey, Pal Singh
CA 561/ BI 505	Principles of Computer Programming	2	1	K.K. Chaturvedi, S.B. Lal
CA 565	Compiler Construction	2	1	Soumen Pal, A.K. Choubey
CA 569	Web Technologies and Applications (2+1)	2	1	Alka Arora, S.B. Lal
CA 570	Computer Graphics	2	1	Pal Singh, S.N. Islam
CA 575	Artificial Intelligence	2	1	Rajni Jain, Sudeep Marwaha
CA 611	Design and Analysis of Algorithms	2	1	Mukesh Kumar, A.K. Choubey
CA 691	Seminar	1	0	Anshu Bharadwaj

Courses taught Semester wise during Academic Year 2020-21

Course Code	Course Name	Credit-L	Credit-P	Name of the faculty allocated for the course
I-SEMESTER				

CA 501	Computers Fundamentals and Programming	2	1	M S Farooqi, S N Islam, Madhu
CA 551	Mathematical Foundations in Computer Science	3	0	A. K. Choubey
CA 560	Computer Organization and Architecture	2	0	Shashi Dhaiya Samarth Godara
CA 561	Fundamentals of Computer Programming	2	1	S. B. Lal, Madhu Samarth Godara
CA 566	Data Base Management System	2	1	Anu Sharma, S N Islam, Sapna Nigam
CA 571	Simulation and Modeling	1	1	Ankur Biswas, Chandan Kumar Deb
CA 573	Data Warehousing and Data Mining	2	1	A. K. Choubey, KK. Chaturvedi, Shashi Dahiya
CA 611	Design and Analysis of Algorithms	2	1	A. K. Choubey, Mukesh Kumar, Madhu
CA 612	Fuzzy Sets and Rough Sets	2	1	Rajni Jain, Alka Arora, Sapna Nigam
CA 613	ANN and Deep Learning	2	1	Anshu Bharadwaj, Md. Ashraful Haque, Sapna Nigam
CA 615	Digital Image Processing	2	1	Alka Arora, Anshu Bharadwaj, Md. Ashraful Haque
CA 691	Doctoral Seminar	1	0	S N Islam

Course taught for the academic session 2020 (Bioinformatics)

Code	Course Title (L + P)	Credits L	Credits P	Instructors
Trimester II (2019-20)				
BI 506	Computational Genomics	3	1	Mir Asif Iquebal, DC Mishra, Sarika, Yasin Jeshima K
BI 513	Elements of Genetics	3	2	As appointment in Genetics

				Division
BI 507 / CA 566	Database Management System	2	2	S.B. Lal, Anu Sharma, Soumen Pal
BI 508	Computer Applications in Bioinformatics	2	1	KK Chaturvedi, S.B. Lal, Anu Sharma,
BI 603	Machine Learning Techniques in Bioinformatics	2	1	Sanjeev Kumar, DC Mishra, Ramasubramanian V.
BI 604	Computational Techniques of Transcriptomics and Metabolomics	1	1	MS Farooqi, Sudhir Srivastava
BI 624	Genome Wide Association Study	2	1	Sunil Archak, Mallikarjuna M.G., DC Mishra
BI 691	Seminar	1	0	Sudhir Srivastava
Trimester III (2019-20)				
BI 502	Protein Structure Analysis	2	1	Anil Rai, Sarika, Yasin Jeshima K
BI 503	Computational Biology	2	1	DC Mishra, Sanjeev Kumar A.R. Rao
BI 504	Evolutionary Biology	2	1	Sunil Archak, Mallikarjuna M.G., A.K. Mishra.
BI 612	Quantum Theory and Application in Biology	2	1	Monendra Grover, Faculty from Ag, Physics
BI 643	Graphics and Visualization Of Biological Data	2	1	Sudeep Marwah UB Angadi
BI 691	Seminar	1	0	KK Chaturvedi

Course	**Course Title**	**Credits**		**Course Instructors 2020-21**
		L	**P**	
Trimester -I 2020-21				
BI 501/ MBB 509	Introduction to bioinformatics	2	1	Sanjeev Kumar, Mallikarjuna MG
BI509/ BIO601	Nucleic acids	2	1	Archana Singh, Archana Sachdev, Suneha Goswami, Vedakrishnan
BI 512	Advanced programming in bioinformatics	2	2	Anu Sharma, UB Angadi

BI 601	Genome assembly and annotation	1	2	Sanjeev Kumar, DC Mishra
BI 602	Biomolecular modelling and simulation	2	1	Sunil Kumar, Sudhir Srivastava
BI 611	Metagenomics data analysis	2	1	MS Farooqi Anu Sharma
BI 613	Parallel programming and algorithm development	2	1	K.K. Chaturvedi, UB Angadi
BI 691	Seminar	1	0	Sudhir Srivastava

Courses taught Semester-wise for the academic session 2020-21 for the discipline of Bioinformatics

Course Code	Course Name	Credit-L	Credit-P	Course Instructors
I-SEMESTER				
BIF 501	Introduction to Bioinformatics	2	1	Sarika, MAIquebal, Yasin Jeshima K
BIF 503	Techniques in Bioinformatics	0	2	Yasin Jeshima, K, RatnaPrabha
BIF 505/ (STAT 511)	Statistical Methods for Applied Sciences	3	1	-
BIF 506	Concepts in Computing	2	2	Anu Sharma, SB Lal, KK Chaturvedi
BIF 507/ (MCA 561)	Fundamentals of Computer Programming	2	1	S.B Lal, Madhu, Samarth Godara
BIF 508/ (MBB 502)	Fundamentals of Molecular Biology	3	0	Sarvjeet Kaur, Rekha Kansal, Monika Dalal
BIF 510/ (GP501)	Principles of Genetics	2	1	Firoz Hossain, Gopal Krishnan, S., Prachi Shripatrao yadav, Haritha Bollinedi
BIF 601	Genome Assembly and Annotation	2	2	DC Mishra, Sanjeev Kumar, NeerajBudhlakoti, Sunil Kumar
BIF 605	Biological Data Integration and Quality Control	2	1	Anil Rai, KK Chaturvedi, SB Lal
BIF 606	Graphics and Visualization Of Biological Data	1	1	UB Angadi, Sudhir Srivastava
BIF 607	Computational System Biology	2	1	Sanjeev Kumar, Prabina K Meher, Samrendra Das
BIF 611	Computational Metagenomics and Microbiome	2	1	Anu Sharma, Mohammad Samir Farooqi, RatnaPrabha
BIF 614	Allele Mining, Gwas and Genomic Selection	2	2	DC Mishra, Sunil Archak, MG Mallikarjuna, Neeraj Budhlakoti
BIF 691	Doctoral Seminar	1	0	DC Mishra

Board of Studies for Academic Year 2020

Agricultural Statistics

1. Dr. Seema Jaggi, Professor (Agricultural Statistics)	Chairperson
2. Dr. Rajender Parsad, Director from 09.10.2020	Member (Ex-officio)
Dr. Tauqueer Ahmad, Director till 08.10.2020	Member (Ex-officio)
3. Dr. Amrit Kumar Paul, Principal Scientist	Member
4. Dr. Susheel Kumar Sarkar, Senior Scientist	Member
5. Dr. Kanchan Sinha, Scientist	Member Secretary
6. Mr. Kapil Choudhary, Student	Students' Representative

Computer Application

1. Dr. Sudeep Marwaha, Professor (CA)	Chairman
2. Dr. Rajender Parsad, Director from 09.10.2020	Member (Ex-officio)
Dr. Tauqueer Ahmad, Director till 08.10.2020	Member (Ex-officio)
3. Dr. Alka Arora, Principal Scientist	Member
4. Dr. Anu Sharma, Senior Scientist	Member Secretary
5. Dr. Soumen Pal. , Scientist	Member
6. Mr. Vaijanath S.K.	Students' Representative

Bioinformatics

1. Dr. Anil Rai Professor (Bioinformatics)	Chairman
2. Dr. Rajender Parsad, Director from 09.10.2020	Member (Ex-officio)
Dr. Tauqueer Ahmad, Director till 08.10.2020	Member (Ex-officio)
3. Dr. Sunil Archak, Principal Scientist	Member
4. Dr. K.K Chaturvedi, Senior Scientist	Member
5. Dr. Sarika, Scientist	Member Secretary
6. Ms. Soumya Sharma	Students' Representative

Central Examination Committee for Academic Year 2020

Agricultural Statistics

1. Dr. Rajender Parsad, Director from 09.10.2020	Member (Ex-officio)
Dr. Tauqueer Ahmad, Director till 08.10.2020	Member (Ex-officio)
2. Dr. Seema Jaggi, Professor (Agricultural Statistics)	
3. Dr. Anil Rai, Head, CABin	
4. Dr. K.N. Singh, Head, Statistical Genetics	
5. Dr. Hukum Chandra, National Fellow	

Computer Application

1. Dr. Rajender Parsad, Director from 09.10.2020	Member (Ex-officio)
Dr. Tauqueer Ahmad, Director till 08.10.2020	Member (Ex-officio)
2. Dr. Sudeep Marwaha, Professor (Computer Application)	
3. Dr. Alka Arora, Principal Scientist	
4. Dr. Anshu Bhardwaj, Principal Scientist	
5. Dr. Shashi Dahiya, Senior Scientist	
6. Dr. Anu Sharma, Senior Scientist	
7. Dr. Soumen Pal,Scientist	

Bioinformatics

1. Dr. Rajender Parsad, Director from 09.10.2020 — Member (Ex-officio)
   Dr. Tauqueer Ahmad, Director till 08.10.2020 — Member (Ex-officio)
2. Dr. Anil Rai, Professor (Bioinformatics)
3. Dr. Seema Jaggi, Head Design of Experiments
4. Dr. S.B Lal, Principal Scientist
5. Dr. Sarika, Senior Scientist

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 the period September 28, 2020 to March 08, 2021. The Course comprise of two independent modules of three months duration each. Two officers participated in both the modules. Module – I was organized during September 28, 2020 to December 11, 2020. Module-II was organized during December 14, 2020 to March 08, 2021. Three officers participated in Module – I and Two 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. Dr Seema Jaggi was the course coordinator of the course.

Topic	**Instructor**
Module-I	
Statistical Methods	Md. Wasi Alam, Anindita Datta & R.S. Shekhawat
Official Agricultural Statistics	Deepak Singh, Ankur Biswas & Kaustav Aditya
Use of Computers in Agricultural Research	Pal Singh, Vandita Kumari & Rajeev Ranjan
Module-II	
Sampling Techniques	Deepak Singh, Raju Kumar & Vandita Kumari
Econometrics & Forecasting Techniques	Md. Wasi Alam, Shivaswami G.P & Anuja A.R
Statistical Genetics	Amrit Kumar Paul, Upendra Kumar & Samarendra Das
Design of Experiments	Anindita Datta, Md. Harun & Sunil Kumar Yadav

Programmes under Centre of Advanced Faculty Training (CAFT)

S. No	Title	No. of Participants	Course Coordinators	Period
1.	Statistical and Machine Learning Techniques for Modeling and Forecasting Agricultural Data	21	Mrinmoy Ray Shivaswamy GP Harish Kumar H.V	20.12.19 to 09.01.20
2.	Advanced Bioinformatics Techniques for Mapping and GWAS using NGS Data	25	Mir Asif Iquebal Sarika	06.02.20 to 26.02.20

Winter School

S. No.	Title	No. of Participants	Course Coordinators	Period
1.	Data Analysis in Agriculture using Statistical Software Packages	25	L.M. Bhar Ranjit Kumar Paul Amrit Kumar Paul	16.01.20 to 05.02.20
2.	Recent Advances in Econometric Modelling and Forecasting in Agriculture	23	Ravindra Singh Shekhawat Anuja A. R. Rajesh T.	04.03.20 to 24.03.20

Training Programmes under HRM

S. No	Title	No. of Participants	Course Coordinators	Period
1.	Experimental Data Analysis (for Technical Personnel of ICAR NARES)	16	B.N. Mandal Sunil Kumar	10.02.20 to15.02.20
2.	Statistical Designs and Experimental Data Analysis (for Scientists)	08	Seema Jaggi Arpan Bhowmik Anindita Datta	18.02.20 to 02.03.20

Resource Generation National/International Trainings

S. No	Title	No. of Participants	Course Coordinators	Period
1.	Data Analysis and Interpretation for Indian Statistical Service (ISS) Funded by (NSSTA)	32	Hukum Chandra Pradip Basak Vandita Kumari	17.08.20 to 28.08.20
2.	Data Analysis and Interpretation for Indian Statistical Service (ISS) Funded by (NSSTA)	30	Hukum Chandra Vandita Kumari Pradip Basak	14.09.20 to 25.09.20

Other Training Programmes

S.No	Title	No. of Participants	Course Coordinators	Period
1.	Sampling Techniques for Crop Cutting Experiments Funded by Directorate of Economic and Statistics, Government of	20	Tauqueer Admad Prachi Misra Sahoo Ankur Biswas	06.01.20 to 10.01.20

	Meghalaya			
2.	Training programme on e-Office at ICAR-Central Institute of Research on Cotton Technology, Matunga, Mumbai	09	Sudeep, Rakesh Kr Saini	09.01.20 to 11.01.20
3.	Organized a training on "Tools and Techniques for Data Analysis and Management" at Institute of Agribusiness Management, SKRAU, Bikaner	93	S. N. Islam, Sudeep Marwaha	20.01.20 to 25.01.20
4.	Implementation of ICAR Research Data Management Guidelines	15	Rajender Parsad, Mukesh Kumar, Sukanta Dash and Susheel Kumar Sarkar	06.02.20 to 07.02.20
5.	Training programme on e-Office at ICAR-Central Inland Fisheries Research, Institute, Barrackpore	88	Sudeep, Rakesh Kr Saini	11.02.20 to 12.02.20
6.	Training programme on e-Office at ICAR-National Institute of Natural Fibre Engineering and Technology, Kolkata	78	Sudeep, Rakesh Kr Saini	13.02.20 to 15.02.20
7.	Two days sensitization workshop-cum Training on Implementation of ICAR Research Data Management Guidelines at ICAR-CRIB, Hisar	32	Naveneet Saxena Vishwa Bharti Susheel Kumar Sarkar, Mukesh Kumar Sukanta Dash	25.02.20 to 26.02.20
8.	Training programme on e-Office at ICAR-Central Soil Salinity Research, Institute, Karnal	65	Sudeep, Rakesh Kr Saini	26.02.20 to 27.02.20
9.	Training programme on e-Office at ICAR-National Dairy Research Institute, Karnal	122	Sudeep, Rakesh Kr Saini	27.02.20 to 28.02.20
10.	Hindi KaryaShala "संगणक एवं सांख्यिकीय तकनीकों का कृषि जैव सूचना में अनुप्रयोग"organized at ICAR-IASRI, New Delhi	12	S B Lal K K Chaturvedi Mohd. Samir Farooqi	05.03.20 to 07.03.20
11.	Statistics: Experimental Designs and Analysis. for M.Sc. Students (17 Horticulture and 9 Plant Protection) of Afghanistan National Agricultural Sciences and Technology University (ANASTU), Kandahar, Afghanistan in collaboration with PG School IARI, New Delhi	26	Seema Jaggi Rajender Parsad Sukanta Dash Arpan Bhowmik	13.04.20 to 08.05.20
12.	EMD, E-File (E-Office)	73	Sudeep	30.04.2020
13.	EMD, E-File (E-Office)	80	Sudeep	01.05.2020
14.	Orientation training program for IASRI Scientists of 110th FOCARS Batch (ARS Probationers)	11	Amrit Kumar Paul	08.05.2020 to 07.06.2020
15.	EMD, E-File (E-Office)	79	Sudeep	22.05.2020 to 25.05.2020
16.	Data Science in Agriculture (under NAHEP project)	150	Sudeep, Anshu Bharadwaj Soumen Pal	26.05.2020 to 31.05.2020
17.	E-File (E-Office)	143	Sudeep	17.06.2020
18.	E-File (E-Office)	193	Sudeep	22.06.2020
19.	Webinar series on "Be+ during Covid-19". In the webinar series, six lectures	1557	Alka Arora Anshu Bharadwaj	22.06.2020 to 27.06.2020

	were organized on different topics by eminent personalities.			
20.	Data Entry Software SIReDAM	10	U.B. Angadi Dinesh Kumar M.A.Iquebal Sarika	09.07.2020 to 13.07.2020
21.	Training on Standardization of Schemes in ICAR-ERP	400	Sudeep Mukesh Kumar	23.07.2020 to 24.07.2020
22.	E-File (E-Office)	15	Sudeep	11.08.2020
23.	Data Entry Software, data collection by CHAMAN methodology	45	Tauqueer Admad Prachi Misra Sahoo Ankur Biswas	20.08.2020
24.	Data Science in Agriculture using R	250	Anshu Bharadwaj Mukesh Kumar Sudeep Shashi Dahiya	07.09.20 to 18.09.20
25.	जीनोमिक ऑकडो का विष्लेषण एवं उपयोगिता	09	Sarika M.A. Iquebal	24.09.20 to 26.09.20
26.	Data Entry in ISLTFE in collaboration with PC Unit, AICRP on LTFE	17	B.N. Mandal	25.09.2020
27.	E-File (E-Office)	14	Sudeep	09.10.2020
28.	कृषि जैव सूचना टूल्स और तकनिकियों का अवलोकन	21	Sudhir Shrivastava Md. Samir Farooqi K.K.Chaturvedi	14.12.20 to 16.12.20
29.	E-File (E-Office)	14	Sudeep	18.12.2020

Chapter 6
Awards and recognitions

(a) Honours/awards

Anil Kumar

- Received Distinguished Scientist award from Society for World Environment, Food and Technology (SWEFT) on February 08, 2020 in its 2nd National Conference on "Technological and Emerging Aspects in Agriculture and Community Science" held at International Buddhist Research Institute, Lucknow.

Dwijesh Chandra Mishra

- Awarded Second prize for a poster presentation entitled "वैरइएसटी: अल्ट्राहाई डायमेंशनल डेटा में जीनोमिक सलेक्शन की एरर वैरिएंस के आकलन के लिए एक आर पैकेज" by Majumdar Sayanti Guha, Rai, A. and Mishra D.C. in Hindi Shodh Patra Pratiyogita held in the institute on September 10, 2020.
- Awarded Third prize for a poster presentation entitled "सीरियल-ईएसटी-डीबी - खाद्यान की फसलों के लिए डेटाबेस" authored by Bhati, J., Kumar, S., Lal, S.B., Mishra DC, Chaturvedi, KK, Sharma, A., Srivastava, S., Farooqi, MS and Rai, A. in Hindi Shodh Patra Pratiyogita held in the institute on September 10, 2020.

K.K.Chaturvedi

- Awarded Third prize for a poster presentation entitled "सीरियल-ईएसटी-डीबी - खाद्यान की फसलों के लिए डेटाबेस" authored by Bhati, J., Kumar, S., Lal, S.B., Mishra DC, Chaturvedi, KK, Sharma, A., Srivastava, S., Farooqi, MS and Rai, A. in Hindi Shodh Patra Pratiyogita held in the institute on September 10, 2020.
- Awarded "Certificate of Appreciation" from Ajay Kumar Garg Engineering College, Ghaziabad for delivering two lectures in AICTE sponsored 2nd One week online Short term Training program on December 08, 2020.
- A paper "Hybrid Approach for Modelling RNA-Seqdata" by Mohammad Samir Farooqi, K. K. Chaturvedi, D. C. Mishra, Sudhir Srivastava, Anil Rai, S.B. Lal, Anu Sharma and Anil Kumar was adjudged the Best Presentation award during National Seminar on Mathematical Sciences: Repositories of Logical Thoughts and Analytical Tools organized by Department of Mathematics & Statistics, COBS&H, CCSHAU, Hisar on December 22, 2020.
- Received the Certificate of Participation in Generic Online Training on Cyber Security after passing the online quiz organized by Ministry of Electronics and Information Technology (MeiTY), Gov. of India.
- Nominated Jury Member (Judge) for Debate Competition (Virtual Mode) on "The money spent in Swachhata activities in India is well spent" on December 22, 2020as a part of Swatchhata Pakhwada Celebrations (16.12.2020 to 31.12.2020).

Mir Asif Iquebal

- Received ICAR sponsored Lal Bahadur Shastri Outstanding Young Scientist Award 2019 in Social Science. This award consists of a cash prize of Rs.1.00 lakh and a challenge project for three years

with budgetary provision of Rs.10.00 lakh per year + Rs. 5.00 lakh for foreign training (upto 3 months) besides Certificate & Citation.


Indian Council of Agricultural Research

Certificate

LAL BAHADUR SHASTRI OUTSTANDING YOUNG SCIENTIST AWARD–2019

(For Social Sciences)

is presented to

Dr. Mir Asif Iquebal

Senior Scientist, Centre for Agricultural Bioinformatics, Computer Building

ICAR-Indian Agricultural Statistics Research Institute, Library Avenue, Pusa, New Delhi

16 July, 2020
New Delhi

(T. Mohapatra)
Secretary (DARE) &
Director General (ICAR)

(Narendra Singh Tomar)
Agriculture & Farmers Welfare Minister, GoI
& President, ICAR Society

- Selected for "InSc Young Achiever Award 2020".

Mohammad Samir Farooqi

- Received Outstanding Achievement Award by Astha Foundation in International Web Conference on Global Research Initiatives for Sustainable Agriculture & Allied Sciences held during December 28-30, 2020 organized by Astha Foundation, Meerut.
- Awarded Doctorate Degree (Ph.D in Statistics) (2020) from Amity University, NOIDA, UP
- Awarded with Best Oral Presentation Award for outstanding presentation of the research work entitled “Hybrid approach for modelling RNA-seq data” by Mohammad Samir Farooqi, K. K. Chaturvedi, D. C. Mishra, Sudhir Srivastava, Anil Rai, S. B. Lal, Anu Sharma and Anil Kumar in Online National Seminar “Mathematical Sciences: Repositories of Logical Thoughts and Analytical Tools” on the occasion of National Mathematics Day on December 22, 2020 by Department of Mathematics & Statistics COBS&H, CCS Haryana Agricultural University, Hisar, Haryana.

  Received third prize for poster entitled “सीरियल-ईएसटी-डीबी - खाद्यान की फसलों के लिए डेटाबेस” authored by Bhati, J., Kumar, S., Lal, S.B., Mishra DC, Chaturvedi, KK, Sharma, A., Srivastava, S., Farooqi, MS and Rai, A. in Hindi Shodh Patra Pratiyogita held in the institute on September 10, 2020.

  (RED marked ones - already occurring in KK Chaturvedi material; whether repeats allowed?)

Neeraj Budhlakoti

- Received Young Scientist Award by Society for Scientific development in agriculture and Technology (SSDAT) in International Web Conference on Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2020) during December 28-30, 2020.

Ranjit Kumar Paul

- Received best paper award for the paper “Asymmetric volatility in onion price at Delhi: Impact of lockdown due to COVID-19” by Debopam Rakshit and R. K. Paul in the Global Conference on ‘Emerging Agricultural Research to Endure the Predicament of COVID-19 Pandemic’ during December 12-13, 2020.

Rajeev Ranjan Kumar

- Secured Third prize in the Quiz programme on the 150th birth anniversary of Mahatma Gandhi at the institute on September 25, 2020.

- Awarded young scientist award on the occasion of international web conference on Global Research Initiative for Sustainable Agriculture and Allied Sciences (GRISAAS-2020) during December 28-30, 2020 from the Society for scientific development in agriculture and technology.

S.B. Lal

- Received the Certificate of Participation in Generic Online Training on Cyber Security after passing the online quiz organized by Ministry of Electronics and Information Technology (MeiTY), Gov. of India.

Samarendra Das

- Received PhD Dissertation Completion Award from Department of Hepatobiology and Toxicology, University of Louisville, Kentucky, USA.
- Received Graduate Dean's Citations award for the 2020 for outstanding contribution to Ph.D. dissertation, University of Louisville, Kentucky, USA.

Sapna Nigam

- Received “Prothsahan Puruskar” at Kavya Path on September 07, 2020 in Hindi Saptah Week.
- Received consolation prize for an essay writing competition on "Swachhta Mission: A Successful Initiative? in Swachhta Pakhwada from December 16-31, 2020.

Sarika

- InSc Research Excellence Award 2020.

Sukanta Dash

- Young scientist award from Society for World Environment, Food and Technology (SWEFT) in its 2nd National Conference on “Technological and Emerging Aspects in Agriculture and Community Science” at International Buddhist Research Institute, Lucknow on February 08, 2020.

(b) Professional recognition

Alka Arora

- Invited speaker in the webinar series “Quantitative Methods for Social Sciences” organized by NIAP, New Delhi on June 17, 2020.
- Guide for Professional Attachment Training (PAT) of Sh. Neetish Kumar, Scientist (Computer Application) at ICAR-CIWA, Bhubaneswar on the topic “Designing the Dashboard of Gender Knowledge System of CIWA” during July 20, **2020 to October 20, 2020**
- Invited Speaker, in International webinar on "DUS testing data management/Automation/Image Analysis organized in collaboration of German Cooperation on Seed Sector Development with PPV&FRA authority on October 07, 2020.
- Member in assessment promotion Committee of technical officer at ICAR-National Research Center for Integrated Pest Management, New Delhi.
- Member in assessment promotion Committee of technical person at ICAR-Central Coastal Agricultural Research Institute, Port Blair.
- Member of Ranking Committee for Agricultural University Ranking System of ICAR.

Anil Kumar

- Member, editorial board, Journal of Agronomy

- Special Guest and Special Speaker in online International Seminar on National Education Policy (NEP) 2020: A Review held at Arya Kanya PG College, University of Allahabad, Allahabad, UP during December 12-13, 2020.

Anil Rai

- Officiating as ADG-ICT in ICAR, New Delhi
- Professor of Bioinformatics in P.G. School, IARI New Delhi
- Conferred as Fellow, NAAS
- Member of the Institute Management Committee of ICAR-Indian Institute of Agricultural Biotechnology, Ranchi
- Member of the Committee for conducting online interviews by ASRB, New Delhi
- Member of organization of Regional Committee-I meeting of ICAR, New Delhi
- Member of organization of Governing Body meeting of ICAR, New Delhi
- Member of organization committee of ICAR Foundation day 2020
- Member of Institute Management Committee of ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi
- Member of Examination Committee of P.G. School, IARI New Delhi in Agricultural Statistics in the institute.
- Member of Examination Committee of P.G. School, IARI New Delhi in Bioinformatics in the institute.
- Member of Examination Committee for admission of UG/PG/Ph.D. students in different agricultural universities
- Member of DPC at ICAR-Research Complex for Eastern Region, Patna for the promotion of scientists
- Member of Board of Studies of P.G. School, IARI New Delhi in Agricultural Statistics
- Member of ICAR Web-site Committee under the Chairmanship of DDG (Ag. Edn)
- In-charge of Institute Library
- Expert member of a National level Committee on Mission Mode in the domain of Precision Agriculture constituted by CSIR under the Chairmanship of Ex- Secretary (DARE) and DG, ICAR
- Expert member of Working Group constituted for the design and development of the IDEA Blueprint by Ministry of Agriculture and Farmers Welfare, New Delhi.
- Expert and Coordinator in National Testing Agency, Ministry of Human Resource Development, U.P.
- Chairman of the Committee for conducting examination of the recruitment of administrative personnel in ICAR

Ankur Biswas

- Member of the Editorial Board of ICAR-IASRI Annual Report 2019.
- Member of the Editorial Board of *Agricultural Research Data Book (ARDB) 2020*.
- Member of the committee for Innovation Excellence Indicators (IEI) Framework Exercise
- Member Secretary of Board of Studies (BOS) for the Discipline of Agricultural Statistics for the academic year 2019-20.
- Member, Institute Seminar Association, ICAR-IASRI

Anshu Bharadwaj

- Chairperson of the Committee for assessment promotion of technical officer at ICAR-National Research Center for Integrated Pest Management, New Delhi.
- Member, Institute Housing Quarter Allotment Committee

Anuja A. R.

- Invited Speaker in the national webinar on “COVID-19 Pandemic: Innovative Agri-Solutions in Vegetable Sector” on the topic “Crop Diversification towards high value crops for enhancing farm income during the COVID-19 Pandemic” organised by ICAR-Indian Institute of Vegetable Research, Varanasi on July 03, 2020

Arpan Bhowmik

- Interview Panel member for recruitment of one JRF in SERB, DST funded project entitled "Improving stability and ensuring targeted delivery of anthocyanin through biopolymer based customized triggered-release formulation" being carried out at Division of Agricultural Chemicals, ICAR-IARI, New Delhi held online on September 04, 2020.

Deepak Singh

- Exhibitor in Pusa Krishi Vigyan Mela-2020 held at ICAR-IARI, New Delhi during March 01-03, 2020

Dwijesh Chandra Mishra

- Organised a session entitled “Statistical Inference-II” as a Chair in an International Conference on Importance of Statistics in Global Emerging Scenario organised at Savitribai Phule Pune University, Pune held during January 02-04, 2020.
- Working as Member Secretary of Divisional Research Committee (DRC)
- Working as Member of the Central Examination Committee for the Academic session 2020-21
- Working as Executive Member, Indian Society of Agricultural Statistics
- Member, Editorial Board, "Proteomics & Bioinformatics: Current Research (PBCR)" Journal
- Member, Editorial Board, "Annals of Genetics and Molecular Biology" Journal
- Working as Member Secretary of Evaluation Committee for publication of “ICAR-IASRI Annual Report” in Hindi
- Working as Member of Editorial Board for Hindi Magazine “सांख्यिकी विमर्श”
- Working as Chairman of a Committee for evaluation of “EPABX System” at the institute

Hukum Chandra

- Chaired technical session on Optimization Techniques in International Conference on "Importance of Statistics in Global Emerging Scenario (ISGES 2020), Savitribhai Phule Pune University, Pune, during January 02-04, 2020.
- Invited Speaker, International Conference on "Importance of Statistics in Global Emerging Scenario (ISGES 2020), Pune, India on January 02-04, 2020.
- Convener for inception workshop on "Evaluation of Agriculture Census Scheme" funded by Department of Agriculture Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India held at our institute on January 31, 2020.
- Invited Speaker, National Conference on "Contribution of Statistics to the Development of Society" at School of Studies in Statistics, Vikram University, Ujjain, Madhya Pradesh during February 07-08, 2020.
- Invited Speaker, Brainstorming session on “Multi-Dimensional Poverty and Small Area Estimation”, organised by Ministry of Statistics and Programme Implementation, Govt of India and UNICEF, New Delhi on February 17, 2020
- Co-Chaired Technical Session on Presentation of Progress Report of the Energy Management in Agriculture (EMA) component for 2019-20 and proposal for technical programme for 2020-21 at MPUAT, Udaipur during February 18-19, 2020.
- Resource Person, Workshop on Statistical Techniques & Data Analysis Using Software at Department of Statistics, MDU, Rohtak on February 28, 2020.
- Invited Speaker, National Workshop on “Research Methodology: Concepts & Applications”, Maharana Pratap University of Agriculture and Technology, Udaipur on June 26-27, 2020.

- Course Director, training programme on “Data Analysis and Interpretation” for the Indian Statistical Service (ISS) Probationers (41st Batch) of Ministry of Statistics & Programme Implementation, Govt. of India. Funded by National Statistical Systems Training Academy (NSSTA), Ministry of Statistics & Programme Implementation, Govt. of India at ICAR-IASRI, New Delhi during August 17-28, 2020 (online).
- Chairman, Committee for the recruitment of Senior Research Fellow under the National Fellow project "Robust and Efficient Small Area Estimation Methods for Agricultural and Socio-economic Surveys and their Application in Indo-Gangetic Plain", ICAR-IASRI, New Delhi on September 15, 2020.
- Course Director, organized a two-week training programme on “Data Analysis and Interpretation” for the Indian Statistical Service (ISS) Probationers (42nd Batch) at ICAR-IASRI, New Delhi during September 14-25, 2020.
- Organizing Secretary, Symposium on “Relevant and Quality Data for Agricultural Research and Policy Planning” to celebrate the third World Statistics Day on October 20, 2021
- Organizing Secretary, Symposium on “Relevant and Quality Data for Agricultural Research and Policy Planning” to celebrate the third World Statistics Day on October 20, 2020.
- Resource Person, 7th Malaysia Statistics Conference 2020: Census Shapes Nation’s Future, Malaysia on October 22, 2020.
- Resource Person, International Workshop on "Statistical Computing using R Software” organized by Department of Statistics, MIT, Art Commerce & Science College, Alandi, Pune during October 29-31, 2020.
- Invited Speaker, Amity Institute of Applied Sciences, Amity University, Uttar Pradesh on November 02, 2020.
- Invited Speaker, International Conference on Prof. CR Rao’s School of Thought on Statistical Sciences organized by the Department of Statistics, Pondicherry University, Pondicherry during November 21-22 & 28-29, 2020.
- Convener for technical session on “Statistics for Achieving Sustainable Development Goals” in the Sixth International Conference on Statistics for Twenty-first Century - 2020 (ICSTC-2020) at the Department of Statistics, Kerala, India during December 16-19, 2020.
- Chaired technical session on “Statistics for Achieving Sustainable Development Goals” in the Sixth International Conference on Statistics for Twenty-first Century - 2020 (ICSTC-2020), University of Kerala, Kerala, India during December 16-19, 2020.
- Convener for Workshop on “Evaluation of Agricultural Census Scheme” funded by Department of Agriculture Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India held at our institute on December 21, 2020.
- Chaired Session on Applied Sciences in National Seminar on “Mathematical Sciences: Repositories of Logical Thoughts and Analytical Tools” at Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana on December 22, 2020.
- Keynote Speaker, National Seminar on “Mathematical Sciences: Repositories of Logical Thoughts and Analytical Tools”, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India on December 22, 2020.
- Chaired technical session on “Recent Developments in Sampling Strategies and Survey Estimation Methods” in International conference on “Statistical Techniques in Business and Industry”, Cochin University of Science & Technology, Cochin, Kerala, December 28-30, 2020.
- Convener for technical session on “Recent Developments in Sampling Strategies and Survey Estimation Methods” in International conference on “Statistical Techniques in Business and Industry”, Cochin University of Science & Technology, Cochin, Kerala, India during December 28-30, 2020.
- Expert Member, subject expert in Agricultural Statistics/Statistics for “Identifying important priority area for formulation of research programme/projects/M.Sc. & Ph.D. research problems and future

course of action for the discipline of Social Science (Agricultural Statistics)" at Central Agricultural University, Imphal on December 31, 2020.

- Invited Speaker, International conference on "Statistical Techniques in Business and Industry" - a regional conference of International Society for Business and Industrial Statistics in conjunction with twenty fifth anniversary of the Department of Statistics, Cochin University of Science & Technology, Cochin, Kerala during 28- 30 December 2020.
- Elected Member, International Statistical Institute, The Netherland.
- Fellow, National Academy of Agricultural Sciences, India.
- Expert Member, Committee to bridge the data gaps for Sustainable Development Goals indicators through Small Area Estimation techniques, Ministry of Statistics and Programme Implementation, Government of India, 2020-21.
- Expert Member, Agricultural Census, Food and Agricultural Organization of the United Nations, Rome, Italy, 2020-21.
- Expert Member, Panel Sample Survey of Households in the State of Tamil Nadu (collaboration with Govt of Tamil Nadu), Madras Institute of Development Studies, Chennai, India, 2017-2021.
- Expert Member, Giri Institute of Development Studies, Lucknow, 2019-2020.
- Expert, Rajasthan Public Service Commission, Government of Rajasthan, 2019-2020.
- Expert and Reviewer, Science and Engineering Research Board (SERB), Department of Science and Technology, Govt of India, 2019-2020.
- Expert and Reviewer, Engineering and Physical Sciences Research Council (EPSRC), United Kingdom, 2019-2020.
- Expert, World Resources Institute India, 2020.
- Member, Governing Body Meeting, Institute of Applied Statistics and Development Studies (IASDS), Lucknow, 2018-2021.
- Adjunct Faculty, Uttar Banga Krishi Viswavidyalaya, Cooch Behar, West Bengal, India.
- Member, Advisory Committee, All India Rural Financial Inclusion Survey 2.0, NABARD, Mumbai, 2019-2021.
- Member, Subcommittee for "Sampling Methods" (MSD 3:6), Bureau of Indian Standards, New Delhi, 2018-2021.
- Member, Sectional Committee on "Statistical Methods for Quality and Reliability", Bureau of Indian Standards, New Delhi, 2020.
- Member Secretary, Quinquennial Review Team of ICAR-IASRI, New Delhi for the Period 2011-2018 (report submitted in 2020).

K.K.Chaturvedi

- Member, Reviewer's Board, International Conference on Machine Intelligence and Data Science Applications organized by UPES Dehradun (MIDAS 2020) during September, 04-05, 2020.
- Member, Editorial Board, International Journal of Current Trends in Engineering & Technology (IJCTET).
- Member, Editorial Board, Pantnagar Journal of Research
- Member, Editorial Board, International Journal of Advanced Research in Computer and Communication Engineering.
- Member, Editorial Board, Journal of Computer Science and Engineering
- Member, Editorial Board, International Journal of Emerging Technology & Advanced Engineering
- Member, Editorial Board, Current Trends in Technology & Sciences

Mohammad Samir Farooqi

- Member of DPC for administrative staff held at our institute on July 14, 2020.
- Expert of selection committee to recruit RA under the project "Generation of hyperspectral signatures of major crop pests from field to Landscape scale for their surveillance and forewarning" carried out at ICAR-NCIPM, New Delhi on December 14, 2020.

Mrinmoy Ray

- Delivered lectures on the topics “Non-linear Growth Model”, “ARIMA-Intervention model” and “Artificial Neural Networks” on January, 25, 2020 in the one-week training programme on “Tools and Techniques for Data Analysis and Management” during January 20-25, 2020 at Institute of Agribusiness Management, Swami Keshwanand Rajasthan Agricultural University, Bikaner.

Mir Asif Iquebal

- Conferred as Associate, NAAS

- Working as Member, Scientific Board, Online Journal of Bioinformatics.
- Working as Member, Editorial Board, International Journal of Genetics and Genomics
- Appointed as Editorial board member Journal of Plant Sciences
- Working as Member Editorial Board of Computational Biology and Bioinformatics
- Working as Editor, Current Agriculture
- Working as Review Editor in Frontiers in Genetics: Bioinformatics and Computational Biology Section.
- Member, Editorial Board, Institute Annual Report 2019
- Member, Editorial Board, IASRI at a Glance.
- Member, Innovation Excellence Indicators (IEI) Committee.

Prachi Misra Sahoo

- Chairperson, Interview Board for the post of IT-III under the project “Integrated Sample Survey Solution for Major Livestock Products” at our institute on July 04, 2020.
- Chairperson, Interview Board for the post of IT-II and YP-II under the project “Integrated Sample Survey Solution for Major Livestock Products” at our institute on July 06, 2020.
- Chairperson, Interview Board for the post of Senior Research Fellow, Consultant and YP-II under the project “Integrated Sample Survey Solution for Major Livestock Products” and for the post of YP-II under the project “Evaluation of Improvement of Agricultural Statistics Schemes (DES)” at our institute on July 07, 2020
- Chairperson, Interview Board for conducting Walk-in interview for the post of Field officer under the different ICAR-IASRI projects at our institute on July 17, 2020.
- Chairperson, Committee for deciding the number of MTS/Office Assistant at the Institute Level.
- Chairperson, Committee for selection of the post of MTS/Office Assistant at the Institute Level.

Prawin Arya

- Member, editorial board, Sankhyiki Vimarsh.

- Chairman, PUSA krishi Vigyan Mela committee for participating in the held during 1-3 March, 2020 at ICAR-IARI, New Delhi.
- External member, for qualifying examination in Agricultural Economics on June 12, 2020.
- Nodal officer, for inspection of our institute by Sansadiya Rajbhasha Samiti on October 31, 2020.
- Member, ICAR-Regional Committee-V Secretariat.
- Welfare Officer, ICAR-IASRI, New Delhi
- Member, ICAR-IASRI Staff Welfare Fund Scheme.
- Member, committee for selection of applicants on compassionate ground.

Rajeev Ranjan Kumar

- Successfully completed Ph.D. (Agricultural Statistics) from P.G. School, ICAR-IARI, New Delhi.

Rajender Parsad

- Co-chair for a Session on Data Management and Big Data Analytics in Agricultural Research and Development organized in ICPulse 2020: International Conference on Pulses, Climate Smart Crops: Challenges and Opportunities by Indian Society of Pulses Research and Development and ICAR-Indian Institute of Pulses Research at MP Tourism Development Corporation, Bhopal during February 10-12, 2020.
- Expert in Virtual Brainstorming Workshop on Identification of New Dimensions for Preparing National/Global Level Database on Women in Agriculture organized at ICAR-Central Institute for Women in Agriculture, Bhubaneswar on August 28, 2020
- Moderator, for Session VII: Copyright Management and Staying Clean of Plagiarism during Workshop cum Training Programme on Intellectual Property Rights in Agricultural Research & Education in India Organized by NAHEP and IP&TM Unit, ICAR, New Delhi during September 12-28, 2020.
- Joined as Director, ICAR-IASRI, New Delhi on October 09, 2020 (AN).
- Honorary Secretary of the Indian Society of Agricultural Statistics from October 09, 2020 (AN).
- Member of Programme Steering and Monitoring Committee (PSMC) under the Biotech-Krishi Innovation Science Application Network (Biotech-KISAN) programme.
- Member, Technical Programme Committee of one day workshop on Data Science for Agriculture and Natural Resource Management organized on December 16, 2020 by Indian Society of Agriculture Information Technology (INSAIT) and Ahmedabad University as a part of 8th International Conference on Big Data Analytics (BDA 2020)

Raju Kumar

- Exhibitor in Pusa Krishi Vigyan Mela-2020 at ICAR-IARI, New Delhi during March 01-03, 2020.

Ramasubramanian V.

- External Question Paper Setter for “Statistical methods” course paper for B.F.Sc. students of Birsa Agricultural University, Ranchi and sent the paper on February 15, 2020.
- Member in Interview Board for selection of One SRF in the project entitled “Studying Dynamics of Market Integration and Price Transmission of Agricultural commodities” carried out at our institute on June 15, 2020.
- Member Selection Board in Interview for recruitment of two IT-III professionals for ICAR-ERP on August 27, 2020.
- Returning Officer for Indian Society of Agricultural Statistics (ISAS) Election held online during September, 2020.
- Chairman of DPC to decide about the promotion of personnel to the post of AAO on September 02, 2020.
- Convenor, for week-long celebration events as part of 150th Birth Anniversary of the Father of the Nation Mahatma Gandhiji during September 25 - October 02, 2020.

- Event Coordinator for Online Special Lectures Session on Gandhian Philosophy on October 01, 2020

S.B. Lal

- Member, Editorial Board, Pantnagar Journal of Research
- Prepared the syllabus for BIF617 (Big Data Analytics in Bioinformatics).
- Member of Compassionate Appointment Committee for direct appointment in Group-C
- External examiner for evaluation of Ph.D. Synopsis presentations for Computer Science discipline of Rabindra Nath Tagore University, Bhopal on October 09, 2020.
- Evaluator for a Ph.D. (Information Technology) thesis titled “An Approach to Filter and Manage Unstructured Data by Applying Data Mining Technique and Artificial Neural Network” of a student of Rabindra Nath Tagore University, Bhopal.
- Member of Interview Board for selection of One YP-II for “Network Project on Agricultural Bioinformatics and Computational Biology (CABin Scheme)” at our institute on December 19, 2020.

Sapna Nigam

- Invited for delivery of two online lectures on "Introduction to Deep Learning" and "Deep Learning: A practical approach” in Five Days online Faculty Development Program on artificial Intelligence (May 25-29, 2020) organized by Department of Computer science & Applications, Dr. Harisingh Gour University, Sagar, Madhya Pradesh.

Sarika

- Associate, NAAS
- Member, National Academy of Sciences (India), Allahabad in Biological Sciences for the year 2020
- Member Secretary, BoS (Bioinformatics) for the Academic session 2020-21
- Member, Central Examination Committee (Bioinformatics) of PG School, IARI for 2019-20
- Member of the Central Examination Committee for the Academic session 2020-21
- Member Editorial Board of Computational Biology and Bioinformatics
- Member, Editorial Board of Institute Newsletter
- Member, Editorial Board, Journal of Fisheries and Life Sciences.
- Member, Editorial Board, Bhartiya Krishi Anusandhan Patrika
- Member, Editorial Board of ARCC Journals.
- Chairperson, Selection committee for the post of SRF under the NASF project "Improving the usability of buffalo spermatozoa by sperm surface remodelling and immune acceptance in female reproductive tract” on September 10, 2020.

Shivaswamy G. P.

- Delivered an online lecture on the topic “Logit, Probit, and Tobit models” on June 3, 2020 in the webinar series on " Quantitative Methods for Social Sciences" organized by ICAR-NIAP during June 1 - 23, 2020.

Sudeep

- Member for selection of the Teaching Associate at Rani Lakshmi Bai Central Agricultural University, Jhansi ,U.P. on February 12, 2020.
- Invited Speaker for delivering lecture on “IT Applications for Agriculture Education” in a National Webinar on “e-Education in Agricultural Sciences in the age of Social Distancing: Opportunities, Challenges and Strategies” organized by AAU, Jorhat on June 05, 2020.
- Invited Speaker for delivering lecture on “ICAR Databases” in “Online sessions for startups” hosted by Pusa Krishi, IARI on August 17, 2020.

- Invited Speaker for delivering lecture on “KVK Portal and Mobile App” in “eTalk: Digital Platforms for Effective Outreach” organized by ATARI, Pune on August 29, 2020.
- Chairman for assessment promotion of technical officer at ICAR-National Research Center for Integrated Pest Management, New Delhi on September 01, 2020.
- Guide for Professional Attachment Training (PAT) of Sh. Dilip Kumar, Scientist (Computer Applications), ICAR-NIAP, New Delhi Study of ICAR-E-platform and website development during July 15, 2020 to October 15, 2020.
- External expert for reviewing IT Policy of AAU, Jorhat as an off-line assignment in November, 2020.
- Guide for Professional Attachment Training (PAT) of Ms. Ritika, Scientist (Computer Applications) of ICAR-IARI, New Delhi on the topic “IARI scholarship automation through Serviceplus” during August 19, 2020 to November 18, 2020.
- National Organizing Committee Member as well as National Level Judging Committee for the Kritagya – Agri SmartTech Hackathon 2020 during December 14-16, 2020.
- Invited Speaker for delivering lecture on “ICT Applications in Agriculture” in “Short term course for students” organized by College of Agriculture, RVSKVV, Gwalior on December 24, 2020.
- Member of Academic Council of P G School, IARI.

Susheel Kumar Sarkar

- Evaluator for presentations by participants of 8th Two Week Refresher Course in Basic Science (Interdisciplinary) (September 10-23, 2020) organized by UGC-Human Resource Development Centre, Jamia Millia Islamia, New Delhi.

Tauqueer Ahmad

- Chairman, Sansthan Rajbhasha Karyanvayan Samiti till October 08, 2020
- Nodal Officer, Nagar Rajbhasha Karyanvayan Samiti (NARAKAS) till October 08, 2020
- Chairman, Institute Research Committee (IRC) Chairman, Institute Technological Management Unit (ITMU) till October 08, 2020
- Chairman, Institute Management Committee (IMC) till October 08, 2020
- Chairman, Technical Monitoring Committee (TMC) for improvement of Fishery Statistics, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Govt. of India till October 08, 2020
- Chairman, Working Group on Agriculture and Rural Statistics till October 08, 2020
- Member, Standing Committee of the Conference of Central and State Statistical Organizations (COCSSO), Central Statistics Office, Ministry of Statistics and Programme implementation, Govt. of India till October 08, 2020
- Member, Technical Committee for implementing Forecasting of Agricultural Output using, SPACE, Agro-meteorology and land Based Observations (FASAL), National Crop Forecasting Centre, Department of Agriculture. & Cooperation, Ministry of Agriculture and Farmers Welfare, Govt. of India
- Member, High Level Coordination Committee for Improvement of Agricultural Statistics (Karnataka) till October 08, 2020
- Member, Working Group for Construction of Index Numbers of Area, Production and Yield of Crops, Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, Govt. of India, New Delhi till October 08, 2020
- Member, Empowered Committee of the Ministry of Statistics and Programme Implementation, Govt. of India for Awards and Fellowship for Outstanding and Meritorious Research Work in Statistics till October 08, 2020 Member, Research Advisory Committee (RAC) of IASRI, New Delhi till 08.10.2020
- Member of Technical Advisory Group (TAG) for Agriculture Statistics and related issues till October 08, 2020

- Member of Sectoral Committee related to SDGs data related matters till October 08, 2020.
- Recognized as Sampling Expert by Food and Agriculture Organization of the United Nations-Laos (FAO-Laos), Vientiane, Lao PDR for providing technical guidance on the sampling strategy to the officials of Lao Statistics Bureau (LSB), Lao PDR and developing sampling methodology for 2019/20 Lao Agriculture Census.
- Expert, General Selection Committee for the post of Professor/Associate Professor in the Department of Statistics & Operations Research and Women's College, Faculty of Science, Aligarh Muslim University (AMU), Aligarh.
- Nominated as Honorary Director, Agricultural Insurance Company of India (AIC) by Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India in October 2020 for consideration of selection on the Board of Directors of AIC before the Search Committee in accordance with the Appointments Committee of the Cabinet (ACC) guidelines.
- Expert Member, Selection Committee for conducting interviews for recruitment of Professor, Associate Professor and Assistant Professor, Statistics, of Aligarh Muslim University (A.M.U.), Aligarh at AMU Campus, Aligarh on November 25, 2020.
- Member, Empowered Committee of the Ministry of Agriculture & Farmers Welfare (MoAFW), Govt. of India to discuss Modalities of Implementation of Two Step Yield Estimation Process under Pradhan Mantri Fasal Bima Yojana (PMFBY) in 2019-20.
- Member, Expert Committee constituted by the MoAFW, Govt. of India for reviewing the technology based crop yield estimation studies at GP level being piloted under PMFBY in states in 2019-20.
- Member, Technical Working Group-1 (TWG-1) constituted by the MoAFW, Govt. of India for technical discussion and future direction on implementation of PMFBY including improvement of methodology for crop insurance using new technology with World Bank support.
- Member, National Level Monitoring Committee (NLMC) as per proviso 29.1 of Revised Operational guidelines of PMFBY in 2019-20.
- Member, Technical Advisory Committee (TAC) of PMFBY for claims settlement and dispute resolution between Insurance Companies and State Governments (farmers) related to PMFBY in 2019-20.
- Expert Member in Statistics for all five Expert Committees constituted by the Horticulture Division, MoAFW, Govt. of India to review the methodology for area and yield estimation of major spices (black pepper, ginger, chilies, turmeric and garlic).
- Member, Technical Committee of Direction (TCD) for improvement of Animal Husbandry and Dairying Statistics, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Govt. of India.
- Chairman, Editorial Board of Agricultural Research Data Book (ARDB) 2020.
- Chairman, CPC of the Institute since November 2021.
- Member, ITMC of the Institute since November 2021.

Vandita Kumari

- Chaired the Contributory Session in the National Conference on Contributions of Statistics to the Development of Society (NCCSDS-2020) at Vikram University, Ujjain, Madhya Pradesh during February 7-8, 2020
- Invited Speaker in National Conference on Contributions of Statistics to the Development of Society (NCCSDS-2020), Vikram University, Ujjain, Madhya Pradesh during February 7-8, 2020.

(c) Membership of Scientific Societies

Associate editor in Food & Scientific Reports, monthly multidisciplinary technical electronic magazine of food, agriculture and allied sciences	Kanchan Sinha

Coordinating Editor, Journal of the Indian Society of Agricultural Statistics (JISAS)	Tauqueer Ahmad
Elected member of International Statistical Institute, Netherlands	Hukum Chandra Rajender Parsad
Executive Member of Indian Society of Agricultural Statistics	M.A. Iquebal Mohammad Samir Farooqi Sarika
Life member Indian Society of Agricultural Engineers	S.B. Lal
Life member of Society of Biotechnology and Bioinformatics	P.K. Meher
Life member of the Society of Statistics, Computer & Application	Ajit Alka Arora Amrit Kumar Paul Anil Kumar Anshu Bharadwaj Anu Sharma B.N Mandal Cini Varghese Dwijesh Chandra Mishra Himadri Ghosh Hukum Chandra Lal Mohan Bhar Mukesh Kumar Pal Singh Prawin Arya Rajender Parsad Ramasubramanian V. Ranjit Kumar Paul S.B Lal Sangeeta Ahuja Seema Jaggi Shashi Dahiya Soumen Pal Sukanta Dash Sunil Kumar Susheel Kumar Sarkar
Life Member of Agricultural Economics Research Association	Ravindra Singh Shekhawat
Life member of American Statistical Association, USA	Samarendra Das
Life member of ASA-ky chapter, Louisville, Kentucky, USA	Samarendra Das
Life member of Bioinformatics and Drug Discovery Society	M.A. Iquebal Sarika Sunil Kumar
Life member of Biotechnology Research Society of India.	Sunil Kumar
Life member of Crop and Weed Science Society (CWSS)	Ranjit Kumar Paul Soumen Pal

Life member of Farming Systems Research and Development Association	Anil Kumar Anshu Bharadwaj K.K. Chaturvedi Md. Wasi Alam Rajender Parsad Shashi Dahiya
Life member of Forum for Interdisciplinary Mathematics	Hukum Chandra Rajender Parsad
Life Member of Indian Association for Reliability & Statistics.	Hukum Chandra
Life Member of Indian Association for the Study of Population.	Hukum Chandra
Life member of Indian Science Congress Association	A R Rao Anil Rai Arpan Bhowmik Prachi Misra Sahoo Rajender Parsad Ramasubramanian V. Ranjit Kumar Paul SN Islam
Life Member of Indian Society for Medical Statistics, India.	Hukum Chandra
Life Member of Indian Society for Probability and Statistics.	Hukum Chandra
Life Member of Indian Society of Agricultural Economics	Ravindra Singh Shekhawat
Life Member of Indian Society of Agricultural Marketing	Ravindra Singh Shekhawat
Life member of Indian Society of Agricultural Statistics	Ajit Alka Arora Amrit Kumar Paul Anil Kumar Anil Rai Anindita Datta Ankur Biswas Anshu Bharadwaj Anu Sharma AR Rao Arpan Bhowmik Bishal Gurung BN Mandal Cini Varghese Deepak Singh Dwijesh C Mishra Himadri Ghosh Himadri Shekhar Roy Hukum Chandra Kaustav Aditya KK Chaturvedi KN Singh Lal Mohan Bhar Md. Harun

	Md. Samir Farooqi Md. Wasi Alam Mir Asif Iquebal Mrinmoy Ray Mukesh Kumar Neeraj Budhlakoti Pal Singh PK Meher Prachi Misra Sahoo Prakash Kumar Prawin Arya Rajeev R. Kumar Rajender Parsad Raju Kumar Ramasubramanian V Ranjit Kumar Paul Sangeeta Ahuja Sarika SB Lal Seema Jaggi Shashi Dahiya SN Islam Soumen Pal Sudeep Marwaha Sudhir Srivastava Sukanta Dash Sunil K. Yadav Susheel K Sarkar Tauqueer Ahmad UB Angadi Vandita Kumari
Life Member of Indian Society of Geo-informatics, Ahmedabad	Prachi Mishra Sahoo
Life member of Indian Society of Ornamental Horticulture	Anil Kumar
Life member of Indian Society of Pulses Research and Development	M.A. Iquebal
Life Member of Indian Society of Remote Sensing, Dehradun	Prachi Mishra Sahoo
Life Member of Indian Statistical Association, India.	Hukum Chandra
Life Member of International Indian Statistical Association	Hukum Chandra Rajender Parsad
Life member of International Journal of Agricultural and Statistical Sciences.	Anil Kumar Prawin Arya
Life member of International Journal of Essential Sciences	Anil Kumar
Life member of International Society for Computational Biology	Sunil Kumar

Life Member of National Academy of Biological Sciences (NABS)	M.A. Iquebal Sarika
Life member of Society for Advancement of Science and Rural Development	K.K. Chaturvedi
Life member of Society for Bioinformatics and Biological Sciences	M.A Iquebal Sarika Sunil Kumar
Life member of Society for Community Mobilization for Sustainable Development.	Anil Kumar Rajesh T.
Life Member of Society for Integrated Development of Agriculture, Veterinary & Ecological Sciences.	Hukum Chandra
Life member of Society for Progressive Research	Anil Kumar
Life member of Society for Recent Development in Agriculture	K.K. Chaturvedi
Life member of Society of Biological Chemist India	Sunil Kumar
Life member of Society of Extension Education	Anil Kumar K.K. Chaturvedi Shashi Dahiya
Life member of the Agricultural Economics Research Association	Anuja A. R. Hukum Chandra Rajesh T. Ranjit Kumar Paul Shivaswamy G. P.
Life member of the Association of Agrometeorologists	Ranjit Kumar Paul Soumen Pal
Life member of the Calcutta Statistical Association	Himadri Ghosh Hukum Chandra Ranjit Paul
Life member of the Indian Meteorological Society	Ranjit Kumar Paul
Life member of the Inland Fisheries Society of India	Ranjit Kumar Paul
Life member of the Society for Application of Statistics in Agriculture and Allied Sciences	L. M. Bhar M.A. Iquebal Ranjit Kumar Paul Soumen Pal
Life member of the Society of Biotechnology and Bioinformatics, OUAT, Bhubaneshwar	Samarendra Das
Life member of The Society of Economics and Development.	Anuja A. R. Shivaswamy G. P.
Member of Computer Society of India	Alka Arora Shashi Dahiya
Member of International Association of Engineers (IAENG)	S.B. Lal
Member, International Association of Survey Statisticians.	Hukum Chandra
Recognized as “Quarterly Franklin Membership" by the Editorial Board of London Journals Press (UK).	Mohammad Samir Farooqi
Secretary, Indian Society of Agricultural Statistics (ISAS), New Delhi till October 08, 2020	Tauqueer Ahmad

(d) Offices in Professional Societies

A. K. Paul

- Joint Secretary of Indian Society of Agricultural Statistics

Anil Kumar

- Associate Editor**,** Indian Research Journal of Extension Education, Society of Extension Education.
- Member, Editorial Board, International Journal of Agricultural and Statistical Sciences.
- Member, Editorial Board, Society for Community Mobilization for Sustainable Development.
- Member, Editorial Board, International Journal of Essential Sciences.
- Member, Editorial Board, Progressive Research.

Ankur Biswas

- Executive Council Member, Indian Society of Agricultural Statistics (ISAS), New Delhi

Anshu Bharadwaj

- Member, Executive Council, Society of Statistics and Computer Applications
- Member, Executive Council , Indian Society of Agricultural Statistics
- Member of Editorial Board, American Research Journal of Computer Science and Information Technology

Anuja A. R.

- Member, Reviewers' Board, Indian Journal of tropical Agriculture
- Member of IASRI brochure committee.
- Member, organizing committee, 50th birth anniversary celebrations of Mahatma Gandhi Ji.
- Member, Certificate preparation committee, 50th birth anniversary celebrations of Mahatma Gandhi Ji.
- Event coordinator, Debate competition, 50th birth anniversary celebrations of Mahatma Gandhi ji.
- Member, Course Coordination Committee, Winter school on Recent Advances in Econometric Modeling and Forecasting in Agriculture" from 4th to 24th March 2020 at ICAR-IASRI, New Delhi.
- Member, Core Faculty, Winter school on Recent Advances in Econometric Modeling and Forecasting in Agriculture" from 4th to 24th March 2020 at ICAR-IASRI, New Delhi.
- Member, purchase and accounts Committee, Winter school on Recent Advances in Econometric Modeling and Forecasting in Agriculture" from 4th to 24th March 2020 at ICAR-IASRI, New Delhi.
- Member, Lecture note preparation committee, Winter school on Recent Advances in Econometric. Modeling and Forecasting in Agriculture" from 4th to 24th March 2020 at ICAR-IASRI, New Delhi.
- Member, Course conduct committee, Winter school on Recent Advances in Econometric Modeling and Forecasting in Agriculture" from 4th to 24th March 2020 at ICAR-IASRI, New Delhi.
- Member, Jury committee in various competitions organized as a part of celebrating Swachhta Pakhwada during 16-31 December, 2020

Arpan Bhowmik

- Editorial Board, Member of Journal of Agriculture and Technology published by Cooch Behar Association for Cultivation of Agricultural Sciences (COBACAS).

D.C. Mishra

- Member secretary of Evaluation Committee for publication of "ICAR-IASRI Annual Report" in Hindi.

- Member of Editorial Board for Hindi Magazine "सांख्यिकी विमर्श"
- Executive Member, Indian Society of Agricultural Statistics
- Member, Editorial Board, Journal "Proteomics & Bioinformatics: Current Research (PBCR)".
- Member, Editorial Board, Journal "Annals of Genetics and Molecular Biology".

HarishKumar H. V.

- Member of boarding and lodging committee and preparation of lecture notes committee formed for the smooth functioning of ICAR Sponsored Winter School on "Recent Advances in Econometric Modeling and Forecasting in Agriculture" from 4th to 24th March 2020 at ICAR-IASRI, New Delhi.
- Member of Board of Studies (BoS) in the Agricultural Economics division, ICAR-IARI, New Delhi for the academic year 2020-21.

Hukum Chandra

- Joint Secretary, Society of Statistics, Computer and Applications.
- Executive Member, Indian Association for Reliability and Statistics, 2020-2023.
- Associate Editor, Journal of Statistical Theory and Practice (Springer).
- Associate Editor, Journal of the Indian Society of Probability and Statistics (Springer).
- Associate Editor, Journal of Model Assisted Statistics and Applications, IOS Press.
- Associate Editor, Statistics and Applications.
- Editor, Journal of Hospitality and Applied Sciences.
- Member Editorial Board, Agrotechnology.
- Member, Board of Editors, Advancements and Developments in Statistical Science.
- Member Editorial Board, Journal of Safe Agriculture.

K.K. Chaturvedi

- Executive Member, Indian Society of Agricultural Statistics.

Kanchan sinha

- DRC secretary in the Division of Forecasting & Agricultural Systems Modelling.
- Member secretary in BoS in the Division of Agricultural statistics, PG School, ICAR-IARI.

Rajender Parsad

- Executive Editor, Statistics and Applications, the Journal of Society of Statistics, Computers and Applications.
- Associate Editor, Journal of Statistical Theory and Practice.
- Associate Editor, Agricultural Research, Journal of the National Academy of Agricultural Sciences published by Springer.
- Member, Editorial Board, Journal of Wheat Research, the Journal of Society for Advancement of Wheat Research.
- Executive President, Society of Statistics, Computers and Applications.
- Member, Governing Body, Institute of Applied Statistics and Development Studies, Lucknow.
- Executive Council Member of the Academy, National Academy of Agricultural Sciences

Rajesh T.

- Deputed as Sector officer for the Delhi Assembly Election 2020 in West Delhi, Assembly Constituency (AC-27) from December 05, 2019 to February 15, 2020.
- Member, committee for boarding and lodging, purchase and accounts, preparation of lecture notes, registration, course conduct committee and committee for selection of participants, ICAR Sponsored winter school on "Recent Advances in Econometric Modeling and Forecasting in Agriculture" (4th

to 24th March 2020), ICAR-IASRI, New Delhi.

Ramasubramanian V.

- Associate Editor for the Journal – Statistics and Applications
- Associate Editor for Journal of Fisheries and Life Sciences

Ranjit Kumar Paul

- Executive Member of Indian Society of Agricultural Statistics
- Executive Member of Society of Statistics, Computer and Applications

Ravindra Singh Shekhawat

- Associate Editor and Reviewer in Bioinfo Publication

S.N. Islam

- Editor of the Journal - Annals of Agricultural Research of Indian Society of Agricultural Science

Sarika

- Member of Managing Committee of ICAR-IASRI Employees Coop. T/C Society Ltd.

Shashi Dahiya

- Member, Executive Council, Indian Society of Agricultural Statistics
- Member of Editorial Board, International Journal of Advanced Computer Science and Applications (IJACSA).

Shivaswamy G. P.

- Member of the lab management committee, course conduct committee, and lecture notes committee during ICAR Sponsored Winter School on "Recent Advances in Econometric Modeling and Forecasting in Agriculture" from March 4 to March 24, 2020, at ICAR-IASRI, New Delhi.
- Member of the Committee for fund allotment in week-long celebrations culminating in the 150th birth anniversary of Mahatma Gandhiji on October 2, 2020.
- Event coordinator of the debate competition as a part of week-long celebrations culminating in the 150th birth anniversary of Mahatma Gandhiji on October 2, 2020.

Soumen Pal

- Member, Editorial Board of the Journal 'RASHI', Society for Application of Statistics and Allied Sciences (SASAA).

Sukanta Dash

- Member of the editorial board of the Journal Progressive Research: An International Journal.
- Member of editorial board of Sankhyki Vimarsh, ICAR-IASRI
- Member of Executive body of Indian Society of Agricultural Statistics.

(e) Membership/Offices in Committees/Panels/Working Groups

A.K. Paul

- External member in SRF Interview board at ICAR- IARI, New Delhi
- Chairman of the Committee for the preparation of tender of Civil Engineering work of IASRI and Krishi Niketan.
- Chairman of DPC for Scientist Probationer Clearance and also for promotion of AAO and Assistant.
- Chairman in Institutes purchase advisory committee.

Alka Arora

- Chairperson of the publication committee for release event of KrishiMegh..
- Chairperson of the committee for Website Contents updating and management.
- Member of Data Centre Management Committee.
- Member, Technical committee in the Project 'Investments in ICAR Leadership in Agricultural Higher Education' under NAHEP Component 2
- Member of ICAR Foundation day committee.
- Member of Board of Studies in the discipline of Computer Applications.
- Member Central Examination Committee in the discipline of Computer Applications.
- Member of committee for finalization of RFP for ICAR-ERP system.

Anil Kumar

- Coordinator of ITH and Panse Hostel.
- Member Coordination Committe for conducting 90th Foundation day of ICAR and Award ceremony.

Ankur Biswas

- Chairman of Course Conduct Committee and member of Core Committee and Editorial Committee in organization of the Training Programme on "Sampling Techniques on Crop Cutting Experiment" at our institute during January 06-10, 2020.
- Member of the Food and Travel Committee in organization of the workshop on "Evaluation of Agricultural Census Scheme" at our institute on January 31, 2020.
- Member Secretary of Board of Studies (BOS) for the Discipline of Agricultural Statistics for the academic year 2019-20.
- Member, Institute Housing Quarter Allotment Committee
- Member, Institute Sports Committee
- Member of Institute Seminar Association.
- Member of the committee for Innovation Excellence Indicators (IEI) Framework Exercise
- Member, Interview Board by the Director of the Institute for conducting Walk-in interview for the post of Field officer and YP-II under the different institute projects held on June 17, 2020.
- Member, Interview Board by the Director of the Institute for conducting Walk-in interview for the post of Consultant, SRFs, IT Professional-II, IT Professional-III and YP-II under the project "Integrated Sample Survey Solution for major livestock products" at our institute held during 04-07 July, 2020
- Member, Interview Board by the Director of the Institute for conducting Walk-in interview for the post of SRF under the project "Integrated Sample Survey Solution for major livestock products" at our institute held on November 7, 2020.

Anshu Bharadwaj

- Worked as Chairman, House Allotment Committee of the Institute
- Worked as member of Central Examination Committee.
- Worked as member of Procurement Committee NAHEP.

Arpan Bhowmik

- Scientist Representative in Institute Grievance Committee of ICAR-IASRI for the year 2018-20.
- Secretary, Swachh Bharat Mission Coordination Committee at ICAR-IASRI.
- Member, Mera Gaon Mera Gaurav (MGMG) Coordination Committee at ICAR-IASRI.
- Member, Executive Committee of IASRI Employees Co-operative Thrift and Credit Society Limited for 2018-20.

- Member, Institute Seminar Association.

B. N. Mandal

- DRC Secretary for the Division of Design of Experiments

D.C. Mishra

- Member secretary of Divisional Research Committee (DRC)
- Member Central Examination Committee (Bioinformatics) of PG School, IARI for 2019-20.
- Member of COVID19 management committee
- Member of house allotment committee for Krishi Niketan Residential Complex, Paschim Vihar, New Delhi
- Working as a chairman of a committee made for evaluation of "EPABX System".
- Working as a member secretary of Evaluation Committee for publication of "ICAR-IASRI Annual Report" in Hindi
- Member of Editorial Board for Hindi Magazine "lkaf[;dh foe'kZ"
- Center coordinator of National Research Centre on Plant Biotechnology, New Delhi for network projects under the CABin Scheme.
- Member of Institutional Work Committee
- Training coordinator for student trainees at CABIN.
- Member of MGMG programme and adopted five villages
- Executive Member, Seminar Association of Institute
- Executive Member of Indian Society of Agricultural Statistics, New Delhi
- Member of major work committee constituted for carrying out major work at Krishi Niketan, Paschim Vihar.

Himadri Ghosh

- Member of Central Examination Committee of ICAR-IASRI in Ag.Statistics
- Member of Board of Studies of ICAR-IASRI in Ag. Statistics
- Member in interview board for selection of candidates for admission to Ph. D. course in the discipline of Agricultural Statistics, Computer Application in Agriculture and Bioinformatics.

Hukum Chandra

- Invited Speaker in National Conference on "Contribution of Statistics to the Development of Society", Ujjain, February 7-8, 2020.
- Invited Speaker in Brainstorming session on "Multi-Dimensional Poverty and Small Area Estimation", organised by Ministry of Statistics and Programme Implementation, Govt of India and UNICEF, New Delhi, February 17, 2020.
- Invited Speaker in National Workshop on "*Research Methodology: Concepts & Applications*", MaharanaPratap University of Agriculture and Technology, Udaipur, June 26-27, 2020.
- Co-Chairman, Institute Annual Report Editorial Committee, 2019.
- Member, Coordination Committee, training programme on "Data Analysis and Interpretation" for the Indian Statistical Service Probationers (41st Batch) of Ministry of Statistics &Programme Implementation, Govt. of India at ICAR-IASRI, New Delhi, August 17-28, 2020.
- Member, Coordination Committee, training programme on "Data Analysis and Interpretation" for the Indian Statistical Service Probationers (42nd Batch) of Ministry of Statistics &Programme Implementation, Govt. of India at ICAR-IASRI, New Delhi, September 14-25, 2020.
- Member, Sectional Committee on "Statistical Methods for Quality and Reliability" (MSD 3), Bureau of Indian Standards, New Delhi, 2020.

- Invited Speaker in Short Course on "Small Area Estimation", the 7th Malaysia Statistics Conference 2020: Census Shapes Nation's Future, Department of Statistics Malaysia, Government of Malaysia, Malaysia, October 22, 2020
- Invited Speaker in International Workshop on "*Statistical Computing using R Software*", Department of Statistics, MIT, Art Commerce & Science College, Alandi, Pune, October 29-31, 2020.
- Supervised Attachment Trainee, Indian Statistical Service (41st batch) Probationer (Mr. AkhileshJha), in the attachment project training at ICAR-IASRI, New Delhi, August-December 2020.
- Guest Speaker in Amity Institute of Applied Sciences, Amity University, Pradesh, November 02, 2020.
- Expert and Reviewer, SERB, Department of Science and Technology, Govt of India, 2019-2021.
- Invited Technical Session on "*Statistics for Achieving Sustainable Development Goals*", in the *Sixth International Conference on Statistics for Twenty-first Century - 2020*, University of Kerala, Kerala, India, 16-19 Dec 2020.
- Keynote Speaker in National Seminar on "Mathematical Sciences: Repositories of Logical Thoughts and Analytical Tools", Chaudhary Charan Singh Haryana Agricultural University (HAU), Hisar, Haryana, December 22, 2020.
- Invited Technical Session on "*Recent Developments in Sampling Strategies and Survey Estimation Methods*", in international conference on "*Statistical Techniques in Business and Industry*", Cochin University of Science & Technology, Cochin, Kerala, 28- 30 December 2020.

K.K. Chaturvedi

- Panelist in National Workshop on "Role of Big Data for AI in Agriculture" in Scientific Consultative Group Meeting on "Artificial Intelligence and Smart Agriculture for Prosperous Bundelkhand" at Rani Lakshmi Bai Central Agricultural University, Jhansi (UP) on March 6, 2020.
- Program Committee (PC) Member, International Conference on Machine Intelligence and Data Science Applications (MIDAS-2020) held at University of Petroleum and Energy Studies Dehradun, India during September 4-5, 2020.
- Chairman, COVID-19 Suraksha Samiti of ICAR-IASRI New Delhi.
- Member, Requirement and Scope, to draft the technical specification, for preparation of RFP & pre-bid, bid opening, evalation of the bids for renewal of AMC and techno refreshment etc. for ASHOKA and ICAR Data Centre committee.
- Member, Finalization of operation and implementation of Cisco Security Solution Committee.
- Institute Representative for iSTEM portal.
- Executive Member, Indian Society of Agricultural Statistics
- Member, Board of Studies (Bioinformatics), PGS School, IARI New Delhi for academic year 2020-21.
- Member, Mera Gaon Mera Gaurav Scheme Committee.
- Member, Management and Functioning of HPC.
- Member, Upgradation and replacement of existing equipment, specification, need of the equipment, OEM, guidance and recommendation for replacement.
- Member, Committee for "Analysis the requirement & scope, draft the specification, preparation & evaluation of the tender for renewal of AMC and techno refreshment of ICAR Data Centre "
- Member, Committee for "Maintenance, Customization and Support for Existing ICAR ERP Application"
- Member, Operational Management and Maintenance of HPC Systems (IT and Non-IT resources) Established under NABG.

Mohammad Samir Farooqi

- Member editorial board of *Sankhyiki Vimarsh* published from ICAR-IASRI.
- Member, National Advisory Committee for the National Seminar on "Mathematical Sciences: Repositories of Logical Thoughts and Analytical Tools" sponsored by Haryana State Council for Science, Innovation and Technology, Panchkula, Haryana at Department of Mathematics and Statistics, COBS&H, CCS Haryana Agricultural University, Hisar on December 22, 2020.
- Member, Mera Gaon Mera Gaurav Scheme Committee.

Mukesh Kumar

- Chairman, PAC committee.
- Transparency Officer and RTI Nodal Officer
- Member of Board of Studies of Computer Application discipline for the academic year 2019-20
- Technical committee member in the Project 'Investments in ICAR Leadership in Agricultural Higher Education' under NAHEP Component 2.
- Worked as Chairman of Bid Evaluation Committee for the procurement of Virtual Classrooms across 18 locations in AUs under NAHEP Component 2 Project.

Pal Singh

- Member, Committee framed for Swachh Bharat Mission
- Member secretary of Board of Studies of Computer Application discipline for the academic year 2019-20
- Worked as a member committee in opening bid for DR under NAHEP project .

Prachi Misra Sahoo

- Secretary, Divisional Research Committee
- Incharge of Geo-informatics Lab., Division of Sample Surveys, IASRI, New Delhi.
- Member of Core Committee for the training programme on "Sampling Technique for Crop Cutting Experiment (CCE)" conducted at ICAR-IASRI during January 06-10, 2020.
- Chairperson, Editorial Committee for the training programme on "Sampling Technique for Crop Cutting Experiment (CCE)" conducted at ICAR-IASRI during January 06-10, 2020.
- Member of Coordination Committee for the training programme on "Data analysis and interpretation" conducted at ICAR-IASRI during August 17-28 06-10, 2020 funded by NSSTA, MoSPI.

Rajender Parsad

- Chief Data Officer, DARE/ICAR for Open Data Initiative of Government of India to function as per National Data Sharing and Accessibility Policy
- Officer Incharge, ITMU and Member Secretary, ITMC.
- Chairman, CPC.
- Chairman, Works Committee
- Member, Committee constituted for examining the family details and fixing a criteria for service on the basis of compassionate grounds.

Raju Kumar

- Member of course conduct committee, Purchase and account committee and travel committee for the training program on "Sampling Technique for crop cutting experiment (CCE)" during 06-10 January 2020.
- Coordinated filling of Questionnaire to IASRI for Third Party Assessment of ICAR Central Schemes/Programs from 2012-13 to 2019-20.

Ranjit Kumar Paul

- Secretary of the Institute Seminar Association

- Member of MGMG committee
- Member of PAPC of the Institute.
- Co-Chairman of Purchase Advisory Committee, ICAR-IASRI

S.N. Islam

- DRC Secretary of Division of Computer Applications
- Member of technical committee in the Project 'Investments in ICAR Leadership in Agricultural Higher Education' under NAHEP Component 2.

Shashi Dahiya

- Member of Institute Seminar Association
- Member in Institute Joint Employee Council (IJSC)
- Member in Invitation Committee for Launch of NARES: Cloud Infrastructure and Services (KrishiMegh).
- Member, Central Examination Committee in the discipline of Computer Applications.
- Member, Technical committee in the Project 'Investments in ICAR Leadership in Agricultural Higher Education' under NAHEP Component 2.
- Chairman in Bid Opening and Evaluation Committee of the Chiller Room RFQ under NAHEP Component 2 Project.
- Social Safeguard Nodal Officer to prepare and finalize the Social Safeguard Plan under NAHEP Component 2 Project.
- Member in Website Content Updating and Management Committee
- Member in Innovations Excellence Indicators Framework.
- Member in Institute Ranking Proforma Updating Committee

Soumen Pal

- Member in the working group formed for ICAR CSC (Common Service Center) collaboration for CSC KVK linking.
- Member Secretary in the BoS for the discipline of Computer Applications.
- Member in the committee for bid evaluation of laptops under NAHEP Component 2 project.
- Chairman of purchase committee for purchasing of items (through spot quotation) under NAHEP.
- Member in Institute's Annual Report Editorial Board committee.
- Member in the committee made for IEI (Innovations Excellence Indicators) Framework exercise for ICAR-IASRI.
- Member of the Central Examination Committee.
- Member of Data Centre Management Committee.
- Member of 'Rajbhasa Karyanwayan'committee.
- Member of 'Mera Gaon Mera Gaurav' committee.
- Member of technical committee in the Project 'Investments in ICAR Leadership in Agricultural Higher Education' under NAHEP Component 2.
- Member in Krishi Unnati Mela for duty at IASRI stall during March 1-2, 2020.

Sudeep Marwaha

- Chairman of BoS for the Discipline of Computer Applications
- Member of ICAR-Data Centre Management Committee
- Member of IASRI Library Journal Rationalization Committee.
- Chairman of Technical Evaluation Committee for procurement of IT Equipment.

Sukanta Dash

- Member of editorial board, Sankhiky Vimarsh

Susheel Kumar Sarkar

- हिंदी पखवाड़ा के अंतर्गत मुख्य आयोजन समिति का सदस्य
- हिंदी पखवाड़ा के अंतर्गत काव्यपाठ के संचालक
- हिंदी पखवाड़ा के अंतर्गत छायांकन समिति का अध्यक्ष
- गाँधी जी कि 150वीं जयंती के उपलक्ष्य में मनाये गए साप्ताहिक कार्यक्रम के अंतर्गत खरीद समिति का अध्यक्ष
- Member of editorial board, Sankhiky Vimarsh

Tauqueer Ahmad

- Member, Consultancy Processing Cell (CPC) of the Institute.
- Incharge of NATP Computer Lab, Division of Sample Surveys, IASRI, New Delhi.

Vandita Kumari

- Member of Editorial Committee and Member of Course Conduct Committee for the training programme on "Sampling Technique for Crop Cutting Experiment (CCE)" conducted at ICAR-IASRI during January 06-10, 2020**.**
- Chairman of Registration committee and Member of Purchase and Accounts committee for the workshop under the project on "Evaluation of Agricultural Census Scheme" funded by Department of Agriculture Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare conducted at ICAR-IASRI, New Delhi on January 31, 2020**.**
- Chairperson of Editorial Committee and Member of Coordination Committee and Online Registration for the training programme on "Data Analysis and Interpretation" organised during August 17-28, 2020.
- Member of "Photography and slide preparation committee" in the "Hindi Saptah" organised during September 7-14, 2020.

(f) Special Lectures delivered by the Scientists at other organizations only

Achal Lama

- "Use of R in Biological Data analysis" on October 11, 2020 in a three-day online training program from 9th to 11th Oct, 2020 entitled "Computational tools used in life science research" organised by Department of Bioinformatics, University of North Bengal, West Bengal.

Anil Rai

- "Computer Intensive Statistical Techniques for agricultural Research and Development" in meeting of NAAS Presentation by newly elected Fellows 2020 on June 25, 2020
- "Log-linear models" on September 19, 2020 in training programme on "Data Analysis and Interpretation" from 14-25 September, 2020 for the Indian Statistical Service probationers of Ministry of Statistics & Programme Implementation, Govt. of India.

Arpan Bhowmik

- "MANOVA", "Principal Component Analysis", "Discriminant Analysis " and "Cluster Analysis" in a training on Tools and Techniques for Data Analysis and Management under NAHEP at Institute of Agri-Business Management, Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan on January 24, 2020

B. N. Mandal

- "An introduction to R software" in a webinar under ICAR-NIAP Webinar Series on Quantitative Methods for Social Sciences on June 01, 2020.

Cini Varghese

- “Incomplete block designs for agricultural experimentation” in Technical Session No. 13 in the fourth national seminar on recent trends in statistical theory and applications-2020 [NSSTA-2020] during June 29 – July 01, 2020.

D.C. Mishra

- "Role of Statistics in Research Methodology" in “National Workshop on Fundamental Concepts and Applications of Research Methodology” held organised by (Bihar Agricultural University, Sabour, Bhagalpur, Bihar during October 06-07, 2020
- "Diagnostics measures in genomic selection" in a Webinar on “Diagnostics and Remedial Measures for common error in application of Statistics” held during 20th-21st October2020 organised by Department of Agricultural Statistics, College of Agriculture, Navsari Agricultural University, Campus Bharuch, Gujarat.
- "Software, Tools & Techniques for computing & Analysing Research Data." in a National e-training on “Research Ethics and Thesis/ Research Paper Writing Skills Development” organised by C.S. Azad University of Agriculture and Technology, Kanpur during November 24-28, 2020.

Dinesh Kumar

- “Transcriptome assembly” in the CAFT Programme Phenomics and Genomic Evaluation of Dairy Animals for Sustainable Production at ICAR-NDRI, Karnal during January 2-22, 2020.
- “Big Data and Artificial Intelligence in Animal Genomics: Opportunities and Challenges” at GADVASU, Ludhiana under NAHEP programme on November 19, 2020
- "Use of NGS data in optimization of health and reproductive efficiency in animals" on December 03, 2020 in training programme on "Physio-biochemical and biotechnological approaches for optimization of health and reproduction in animals"() at Department of Veterinary Physiology & Biochemistry, College of Veterinary Science & A.H., Mhow, NDVSU, Jabalpur M.P during December 01-21, 2020.
- "Plant variety protection and Geographical indication law in Indian agriculture: Challenges" at Centre of Excellence in Agri Biotechnlology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut ONLINE Faculty Training on "Application of Molecular and Bioinformatic Tools in Agriculture and Allied Sciences" during December 11-24, 2020.

Harish Kumar H. V.

- “Linear programming” on June 12, 2020 in the Webinar series on “Quantitative Methods for Social Sciences” held during June 01-23, 2020 by ICAR-NIAP, New Delhi.

K.K. Chaturvedi

- “ASHOKA: Super Computer” on March 02, 2020 in NAHEP sponsored training progam “Genomics for Improvement of Horticultural Crops”, Division of Vegetable science, ICAR-IARI, New Delhi during February 24 to March 05, 2020.
- “Role of Big Data for AI in Agriculture” in Scientific Consultative Group Meeting on “Artificial Intelligence and Smart Agriculture for Prosperous Bundelkhand” on March 6, 2020 at Rani Lakshmi Bai Central Agricultural University, Jhansi (UP).
- "Research Ethics" in a National e-training on “Research Ethics and Thesis/ Research Paper Writing Skills Development” organised by C.S. Azad University of Agriculture and Technology, Kanpur during November 24-28, 2020.
- “Challenges and Opportunities in Data Science” on December 08, 2020 in AICTE Sponsored 2nd one week STTP on “Data Science with Python” organized by Ajay Kumar Garg Engineering College, Ghaziabad.

M. A. Iquebal

- “In silico mining of SSR markers and its application in Agriculture” in the CAFT Programme Phenomics and Genomic Evaluation of Dairy Animals for Sustainable Production held at ICAR-

NDRI, Karnal during January 2-22, 2020.

- "Gene Expression studies using NGS Data" at Centre of Excellence in Agri Biotechnology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut ONLINE Faculty Training on "Application of Molecular and Bioinformatic Tools in Agriculture and Allied Sciences" during December 11 to December 24, 2020.

Rahul Bannerjee

- "Analysis and graphical presentation of Biological data using computational tools" in the three days Online Training Program viz. "Computational tools used in life science research" on October 11, 2020 organized at Department of Bioinformatics, University of North Bengal, West Bengal.

Rajender Parsad

- "Relevance of Modern Statistical Procedures in Agrochemical Research" on January 09, 2020 in Winter School on Harnessing New Generation Green Technologies from Plant, Microbial and Waste Source for Sustainable Crop, Environmental and Human Health held at Division of Agricultural Chemicals, ICAR-IARI, New Delhi during December 26, 2019 - January 15, 2020.
- "Research Data Management and Scientific Communication in Virtual Soft Skill Development Programme on Scientific Writing in Social Sciences organized by University of Agricultural Sciences, Dharwad under NAHEP-Institutional Development Plan on July 06, 2020.
- "Web Resources and Statistical Computing" in Webinar on Experimental Research in Social Science organized by Bihar Agricultural University, Sabour, Bhagalpur (Dr Kalam College, Kisanganj) on July 13, 2020.
- "Web Resources on Design of Experiments" and "Statistical Computing and Indian NARS Statistical Computing Portal" on July 17 and July 21, 2020 respectively in Online Refresher Course on Statistical Tools and Techniques for Analysis of Agricultural Data for Teachers and Scientists of SAUs organized by Academy of Agricultural Research and Education Management, CCS HAU Hisar during July 08-28, 2020.

Raju Kumar

- "Inferential Statistics", "ANOVA" and "Non Parametric tests" on January 23, 2020 in "Training on Tools and Techniques for Data Analysis and Management" at SKRAU, Bikaner during January 20-25, 2020.

Ramasubramanian V.

- "Multi-Dimensional Scaling (MDS)" on January 04, 2020 to the students of ICAR-CIFE, Mumbai who had registered for the course on "Advanced Statistical Methods".
- "Correlation and Regression Analysis", "Classification And Regression Tree (CART)", "Time Series Analysis" and "Multi-Dimensional Scaling" on January 22, 2020 in "Training on Tools and Techniques for Data Analysis and Management" at SKRAU, Bikaner during January 20-25, 2020.
- "Logit &Probit analysis" and "Markov chain" on March 02, 2020 in the Workshop cum training entitled "Market analytics with R – Phase-II" conducted under NAHEP-CAAST at AAU, Anand during March 02-04, 2020
- "Introduction to R" and "R programming" on May 12, 2020 in an Online Faculty Development Programme on Data Science organized by Department of Computer Science and Applications, Dr. Harisingh Gour University, Sagar, M.P. during May 09-13, 2020.
- "Linear and Nonlinear Regression models inAgriculture" in the Webinar on "Application of Statistical Models in Agricultural Sciences-An Overview" on August 12, 2020 organized by Agricultural College and Research Institute (TNAU), Madurai.
- "Linear, Non-linear and logistic regression in fisheries data analysis" on August 25, 2020 in the online training programme on "Data analytics in fisheries" conducted by Tamil Nadu Dr. JJ Fisheries University, Nagapattinam during August 10, 2020 to September 03, 2020

Sarika

- "Marker discovery using NGS data" in Online Faculty Training on "Application of Molecular and Bioinformatic Tools in Agriculture and Allied Sciences" organized by Centre of Excellence in Agri Biotechnology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut during December 11 - 24, 2020.

Seema Jaggi

- “Testing of Hypothesis” and “Analysis of Experimental Data using SPSS” on July 14, 2020 and July 23, 2020 respectively in the Refresher Course on Statistical Tools and Techniques for Analysis of Agricultural Data organized by CCS Haryana Agricultural University, Hisar during July 8-28, 2020.

Shivaswamy G. P.

- “Logit, Probit, and Tobit models” in the Webinar series on " Quantitative Methods for Social Sciences" organized by ICAR-NIAP from June 01-23, 2020.

Sunil Kumar

- Delivered two lectures on September 11, 2020 in UGC sponsored refresher course in Life Science at Ranchi University, Ranchi during September 01-14, 2020.

Chapter 7
Linkages and Collaborations

Linkages and Collaborations in India and abroad including externally funded projects (Jan- Dec, 2020)

Sr. No.	Title	Collaborative /Funding agency	Date of Start	Date of completion
1	Planning, designing and analysis of experiments planned ON STATION under AICRP on IFS	ICAR-IIFSR	01.04.2017	31.03.2021
2	Designing and analysis of ON FARM research experiments planned under AICRP on IFS	ICAR-IIFSR	01.04.2017	31.03.2021
3	Planning, designing and analysis of data relating to experiments for AICRP on Long Term Fertilizer experiments	AICRP LTFE	01.04.2017	31.03.2021
4	ICAR Research Data Repository for Knowledge Management as KRISHI: Knowledge based Resource Information System Hub for Innovations in Agriculture:	ICAR Headquarters EFC Scheme: NAARM, NBSSLUP, IARI, CRIDA, CMFRI, DKMA as partners and all other ICAR Institutes as Nodal Centers	24.07.2015	31.03.2021
5	Genomics assisted crop improvement and management	ICAR-IARI, New Delhi	26.09.2018	31.03.2021
6	Application of Next-Generation Breeding, Genotyping, and Digitalization Approaches for Improving the Genetic Gain in Indian Staple Crops	IARI, New Delhi	22.01.2019	21.01.2023
7	Plant source based environmentally safe crop protection and production technologies: Development and	IARI, New Delhi	27.03.2019	06.02.2022

	capacity building			
8	Statistical approach for genome-wide association studies and genomic selection for multiple traits in Structured plant and Animal population.	Funded by Science and Engineering Research Board, DST Government of India	20.06.2017	15.03.2021
9	Doubling Farmers' Income in India by 2021-22: Estimating Farm Income and Facilitating the Implementation of Strategic Framework	Ministry of Agriculture and farmer welfare	31.03.2017	31.03.2022
10	Modelling insect pests and diseases under climate change and development of digital tools for pest management	NICRA project funded by CRIDA(DBT funded)	20.06.2017	31.03.2021
11	Studying Dynamics of market integration and price transmission of agricultural commodities	ICAR Funded	02.04.2018	31.03.2021
12	Energy Audit Survey of AICRP on Energy in Agriculture & Agro-based Industries: Sampling Design and Analysis	ICAR-All India Coordinated Research Project on "Energy in Agriculture & Agro-based Industries	01 June, 2018	31 .05 2021
13	Integrated Sample survey Solution for major Livestock products	DAHDF, MoAFW, Govt. of India	27.03.2019	30.09.2020
14	Development and assessment of educational mobile apps for improving livestock health and production	Collaborative with ICAR-IVRI Institute Project	28.06.2017	31.03.2021
15	Knowledge Management System for Agriculture Extension Services in Indian NARES:	ICAR-Extramural Research Project funded by Agricultural Extension Division	04.03.2016	31.03.2021
16	Management and Impact Assessment of Farmer FIRST Project	Collaborative with ICAR-NIAP and Funded by ICAR	01.02.2017	31.03. 2020

17	ICT based Extension Strategies for Nutrition Sensitive Agriculture in the States of UP and Odisha	NASF	01.11.18	31.10 2021
18	Computational biology approach for deciphering stress induced transcriptomic and proteomic changes in rice-microbial system	NBAIM, Mau Funded by CABin, ICAR-IASRI	06.03.2018	31.03.2020
19	Potential Gene Mining from Salt Tolerant Grasses for Improvement of Stress Tolerance in Crops	National Fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA), Indian Council of Agricultural Research, New Delhi	01.06.2017	30.11.2020
20	RiceMetaSys: Understanding rice gene network for blast resistance and drought tolerance through system biology approach	ICAR-NRCPB, New Delhi	July 2017	30.06. 2020
21	Computational and experimental biology approaches for delineation of selected secondary metabolite pathways and antimicrobial peptides (AMPs) in major spices	(In collaboration with ICAR-IISR, Kozhikode)	05.03.2018	30.06. 2020
22	Genomic data analysis to elucidate the regulatory network and candidate genes underlying cytoplasmic male sterility in pigeonpea	(In collaboration with ICAR-IIPR, Kanpur)	05.03.2018	31.03. 2020
23	Computational approach for genomic resource improvement and precision phenotyping of less explored yield traits in wheat	(In collaboration with ICAR-IIWBR, Karnal)	05.03.2018	30.06. 2020
24	Deciphering genetic variation in the carbohydrate metabolism of farmed rohu families.	(In collaboration with ICAR-CIFA, Bhubaneshwar)	05.03.2018	30.06. 2020
25	An integrative transciptomics and DNA methylomics approach to	(In collaboration with ICAR-CIRB, Hisar)	16.01.2019	30.06. 2020

	understand the dynamic features of biotic stress responses associated with mastitis in buffalos	(Project Code: AGEDIASRICOP2019 00100147)		
26	ICAR Network Project on Functional Genomics and Genetic Modification (Earlier ICAR Network Project on Transgenic in Crops	NRCPB, New Delhi	27.01.2015	30.06.2021
27	Improving the usability of buffalo spermatozoa by sperm surface remodeling and immune acceptance in female reproductive tract (NASF).	ICAR-NDRI	12.07.2018	11.07.2021
28	Molecular markers for improving reproduction of cattle and buffaloes - Funded by Bill and Melinda Gates Foundation (BMGF)	ICAR-NDRI, ICAR-CIRB	19.09.2018	30.09.2023
29	Molecular characterization, development of molecular markers and metabolite analysis of Tree bean (*Parkia roxburghii*) landraces of North-East India (DBT Funded)	ICAR Research Complex for NEH Region (Gangtok, Sikkim Centre) and UBKV, West Bengal	15.03.2019	14.03.2022
30	Development of web server for phenotype and genotype analysis for cattle breeding management	ICAR-CIRC, Meerut	12.03.2018	31.03.2021
31	Genome and transcriptome sequencing of coriander (*Coriandrum sativum*) to reveal insight of its genomic architecture and breeding targets	JAU, Junagarh	14.03.2018	31.03.2021
32	Genomics assisted crop improvement and management - Centre for Advanced Agricultural Science and Technology (CAAST) project funded by National Agricultural Higher Education Project (NAHEP).	ICAR-IARI, ICAR-NBPGR and ICAR-NIPB	26.09.2018	31.03.2021
33	RiceMetaSys: Understanding rice gene network for blast resistance and drought tolerance through system	ICAR-NRCPB, New Delhi	01.03.2018	30.06. 2020

	biology approach			
34	Computational and Analytical Solutions for High-throughput Biological Data	All Bureaux /ICAR Consortium Research Platform on Genomics	April 2017	30.03. 2021
35	Genome wide association study in Indigenous poultry breeds/varieties	ILRI, ICAR-DPR and ICAR-IASRI		
36	Robust and Efficient Small Area Estimation Methods for Agricultural and Socio-Economic Surveys and Their Application in Indo-Gangetic Plain (PI: Dr. Hukum Chandra)	ICAR-National Fellow Scheme, ICAR	25.11.2014	24.11.2024
37	Energy Audit Survey of AICRP on Energy in Agriculture & Agro-based Industries: Sampling Design and Analysis (PI: Dr. Hukum Chandra)	ICAR-All India Coordinated Research Project on "Energy in Agriculture & Agro-based Industries & ICAR-CIAE, Bhopal	01.06.2018	31.05.2021
38	Study to estimate the sub-state level estimate of socio-economic indicators of Uttar Pradesh by using Small Area Estimation Techniques (PI: Dr. Hukum Chandra)	Giri Institute of Development Studies, Lucknow, Uttar Pradesh and Directorate of Economics & Statistics, Government of Uttar Pradesh	01.06.2019	31.05.2020
39	Feasibility Study for Developing Renewable Energy Systems for Tea Plantations in Assam (PI: Dr. Hukum Chandra)	Indian Institute Technology, Delhi	01.02.2020	31.0.2022
40	Explicating genomic insights of Indigenous equines breed population through "Computational Genomics" and "Artificial Intelligence" based approaches.	ICAR-NRCE, Hissar	17.08.2020	30.11.2022
41	Mainstreaming rice landraces diversity in varietal development through genome wide association	ICAR-IARI	01.05.2020	30.04.2025

	studies: A model for large-scale utilization of gene bank collections of rice. (DBT)			
42	Germplasm Characterization and Trait Discovery in Wheat using Genomics Approaches and its Integration for Improving Climate Resilience, Productivity and Nutritional Quality. (DBT)	ICAR-NBPGR	01.04.2020	31.03.2025
43	Minor Oilseeds of Indian Origin: Mainstreaming sesame germplasm for productivity enhancement and sustainability through genomics assisted core development and trait discovery. Funded by DBT.	ICAR-NBPGR	29.02.2020	
44	Genome wide association study in Indigenous poultry breeds/varieties.	ILRI, ICAR-Directorate of Poultry Research, ICAR-DPR	21.05.2020	31.03.2022
45	Identification and functional characterization of the key resistance/susceptible determinants for Sclerotinia stem rot disease in oilseed Brassica. (DST).	ICAR-NIPB,	30.12.2020	31.12.2023
46	Evaluation of Agricultural Census Scheme (PI: Dr. Hukum Chandra)	Department of Agriculture Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt of India, New Delhi,	01.01.2020	30.06.2020

Chapter 8
Publications

1. Abhishekh, M.P., Kumar, M.J., P, Dahiya, S., Arora, A. and Pal, S. (2019). Development and validation of mobile based decision support system for postural assessment of agricultural activities using rapid upper limb assessment (RULA) technique, *Progressive Research- An International Journal*, **14 (Special)**, 335-337.
2. Aditya, K., Chandra, H., Basak, P., Kumari, V. and Das, S. (2020). District level crop yield estimation with reduced number of crop cutting experiments. *Indian Journal of Agricultural Sciences*, **90 (6)**, 1185–1189.
   http://krishi.icar.gov.in/jspui/handle/123456789/46426
3. Aditya, K., Gupta, S., Guha, S. and Verma, B. (2020). Food and nutrition in Indo gangetic plain region-A disaggregate level analysis. *Current Science*, **119(11)**, 1783-1788.
4. Agrawal, A., Venkatesan, T., Ramasamy, G.G., Syamala, R.R., Muthugounder, M. and Rai, A. (2020). Transcriptome alterations of field-evolved resistance in Pectinophoragossypiella against Bt Bollgard II cotton in *India. J. Appl. Entomol*. 2020, **144**,929–940; DOI: http://onlinelibrary.wiley.com/doi/full/10.1111/jen.12805
5. Ahirwar, R.N., Mishra, V.K., Mishra, D.C., Budhlakoti, N., Singh, S. and Chand, R. (2020). Biplot analysis for spot blotch and yield trait using wami panel of spring wheat. *Journal of Experimental Biology and Agricultural Sciences*, **8(2)**, 115–124. .http://krishi.icar.gov.in/jspui/handle/123456789/42652.
6. Ahmad, T., Sud, U.C., Rai, A. and Sahoo, P.M. (2020). An Alternative Sampling Methodology for Estimation of Cotton Yield using Double Sampling Approach. *Journal of the Indian Society of Agricultural Statistics*, **74(3)**, 217-226.
   http://krishi.icar.gov.in/jspui/handle/123456789/45377
7. Ahmadi, N.M., Das, T.K., Nasrat, N., Rathore, S.S. and Paul, A.K. (2020): Effect of phosphorus on yield and economics of maize (Zea mays) under semi-arid conditions of Afghanistan. *Indian Journal of Agricultural Sciences*, **90 (2)**, 439–41.
8. Anjoy, P. and Chandra, H. (2020). Disaggregate-level disparity in the incidence of poverty in Chhattisgarh. *Agricultural Economics Research Review*, **33 (1)**, 23-33.
9. Anjoy, P., Chandra, H. and Aditya, K. (2020). Spatial Hierarchical Bayes small area estimation for disaggregate level crop acreage estimation. *Indian Journal of Agricultural Sciences*, **90(9)**, 1780-85.
   http://krishi.icar.gov.in/jspui/handle/123456789/46419
10. Anjoy, P., Chandra, H. and Parsad, R. (2020). Estimation and Spatial Mapping of Incidence of Indebtedness in the State of Karnataka in India by Combining Survey and Census Data. *Statistics and Applications*, **18(1) (New Series)**, 21–33.
    http://krishi.icar.gov.in/jspui/handle/123456789/36705
11. Anjum, A., Jaggi, S., Varghese, E., Lall, S., Rai, A., Bhowmik, A., Mishra, D.C. and Sarika (2020). Mixture distribution approach for identifying differentially expressed genes in microarray data of Arabidopsis thaliana. *Indian Journal of Agricultural Sciences*, **90(10)**, 139-143.
    http://krishi.icar.gov.in/jspui/handle/123456789/43025
12. Anndonissamy, J., Bhati, J., Mishra, D.C., Chaturvedi, K.K., Rao, A.R., Rai, A., Singh, I. and Sikka, P. (2020). MicroRNA-related markers associated with corpus luteum tropism in buffalo (Bubalusbubalis). *Genomics*. **112(1)**, 108-113. doi: 10.1016/j.ygeno.2019.01.018. http://krishi.icar.gov.in/jspui/handle/123456789/44141
13. Anuja, A.R., Kar, A., Jha, G.K., Kumar, P., Burman, R., Singh, K.N. and Shivaswamy, G.P. 2020. Pattern and implications of labour migration on technical efficiency of farm households: A study in Bundelkhand region of central India. *Indian Journal of Agricultural Sciences*, **90(10)**, 1877–82.
    http://krishi.icar.gov.in/jspui/handle/123456789/43003.

14. Anuja, A.R., Kumar, A., Saroj, S. and Singh, K.N. (2020). The impact of crop diversification towards high-value crops on economic welfare of agricultural households in eastern India. *Current Science*, **118(10)**, 1577-1582. doi: 10.18520/cs/v118/i10/1575-1582. http://krishi.icar.gov.in/jspui/handle/123456789/38240
15. Bahadari, S., Singh, Y.V., Baray, S.M., Shivay, Y.S. and Parsad, R. (2020). Influence of foliar application of nitrogen on growth and yield of mungbean (*Vignaradiata*) varieties in Kandahar region of Afghanistan. *Indian Journal of Agronomy*, **65(1)**, 111-115.
16. Bahadari, S., Singh, Y.V., Baray, S.M., Shivay, Y.S., Parsad, R. and Sayedi, S.A. (2020). Effect of foliar application of nitrogen and varieties on productivity and profitability of mungbean (Vignaradiata) in Afganistan. *Indian Journal of Agricultural Sciences*, **90(3)**, 72-75. http://krishi.icar.gov.in/jspui/handle/123456789/37503
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20. Banerjee, R., Sheoran, S., Kumar, S., Sanodiya, R., Dhanya, V.G. and Samota, M.K. (2020). Participatory Rural Appraisal Techniques for Problem Identification and Formulation of Village Agricultural Development Plan of Chosla Village. *Asian Journal of Agricultural Extension, Economics & Sociology*, **38(9),** 80-99. DOI: http://doi.org/10.9734/ajaees/2020/v38i930410ᵺ http://krishi.icar.gov.in/jspui/handle/123456789/44339
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Chapter 9
Paper presentations and participation

1. Division of Design of Experiments

Papers presented

- Following papers were presented by the first author in the International Conference on Importance of Statistics in Global Emerging Scenario organized by Department of Statistics, Savitribai Phule Pune University in conjunction with 22nd Annual Conference of the Society of Statistics, Computer and Applications at Pune University, Pune during 2-4 January, 2020:

  - ✓ Rajender Parsad. Data Management in Indian Agricultural Research and Development. Plenary Talk in Professor C.R. Rao Birth Centenary Lecture Session.. (Plenary Talk) delivered on January 02, 2020
  - ✓ Eldho Varghese, Arpan Bhowmik, Seema Jaggi, Cini Varghese, Hemavathi M. and Sathianandan, T.V. Run order considerations for response surface designs. (Invited talk)
  - ✓ Anubhav Roy, Seema Jaggi, Anil Rai, Eldho Varghese, Arpan Bhowmik and D.C. Mishra. Study on change-points in E. Coli genome.
  - ✓ Hemavathi M., Eldho Varghese, Shashi Shekhar, Sathianandan T.V. and Seema Jaggi. On the construction of third order asymmetric rotatable designs.
  - ✓ Susheel Kumar Sarkar. Digitalization approaches in Agriculture.(Invited Talk)
  - ✓ Sukanta Dash (2020). Designs for computer experiments useful in Agriculture Engineering. (Invited Talk)

- ICPulse 2020: International Conference on Pulses, Climate Smart Crops: Challanges and Opportunities organized by Indian Society of Pulses Research and Development and ICAR-Indian Institute of Pulses Research at MP Tourism Development Corporation, Bhopal during February 10-12, 2020
- **Rajender Parsad***. **Data Management and Big Data Analytics in Agricultural Research and Development** delivered on February 11, 2020
- **Rajender Parsad***. Agricultural Knowledge Resources and Information Systems Hub for Innovations: Current Status and Way forward. [in Online Experts Meet on ICAR-Geoportal Spatial Data Infrastructure and Applications-Way forward on June 2, 2020 organized by partner centre ICAR-NBSS&LUP, Nagpur.]
- larqfyr viw.kZ ySfVu oxkZdkj vfHkdYiuk,a ¼**lqdkUr nk'k***] ch-,u- eaMy] jktsUnz izlkn ,oa mn;ohj flag½ 10 flrEcj 2020 dks fMftVy 'kks/k&iksLVj izLrqfrA
- मोहम्मद हारून, सिनी वर्गीस, सीमा जग्गी, अनिंदिता दत्ता, एल्दो वर्गीस एवं अर्पण भौमिक । चार-पथ आनुवंशिक क्रॉस के लिए संवर्धित संगमन अभिकल्पनाएँ ।
- अनिंदिता दत्ता, सीमा जग्गी, सिनी वर्गीस, एल्दो वर्गीस, अर्पण भौमिक एवं मोहम्मद हारून । कृषि में जनरेलाइज्ड रो-कालम अभिकल्पनाओं का प्रयोग ।
- Workshop and Annual Review Meeting of ABIs/ ZTMCs/ ITMUs under ICAR institutes of NRM, Agricultural Engineering and Agricultural Education Divisions organized on November 23-24, 2020
  - Rajender Parsad. ICAR-IASRI ITMU Achievements for 2017-18 to 2019-20 and Future Work Plan.

- International Virtual Conference on Prof. CR Rao's School of Thought on Statistical Sciences was organized by Department of Statistics, Pondicherry University, Pondicherry during 21st, 22nd, 28th & 29th of November
  - Rajender Parsad*. Web Resources For Research & Dissemination in Statistical Sciences. (Invited Talk, presented on November 29, 2020)
- Seema Jaggi. Invited talk on **Some Developments in Response Surface Methodology with Overlap Effects** in a workshop on **Response Surface and Mixture Experiment Methodologies for Agricultural and Fisheries Experimentation** held by ICAR-CMFRI, Kochi on December 16, 2020.
- Cini Varghese**.** Made a presentation on "**progress on statistical analysis of on-farm nutrient response and farming system experiments** (OFR 1, 2 & 3)" in the VI (XXXIV) Biennial Workshop of **AICRP on Integrated Farming Systems** on 15 December, 2020 through virtual mode.

Rajender Parsad

- Workshop on Response Surface and Mixture Experiment Methodologies for Agricultural and Fisheries Experimentation organized by ICAR-CMFRI, Kochi on December 16, 2020
- Rajender Parsad*. Response Surface Methodology and Mixture Experiments: An Application Perspective (invited Talk)
- National Seminar on Mathematical Sciences: Repositories of Logical Thoughts and Analytical Tools for the Celebration of National Mathematics Day organized by Department of Mathematics and Statistics, CCSHAU, Hisar on December 22, 2020
- Rajender Parsad*. Significance of Experimental Designs in Agricultural Research and Web Resources (Keynote Technical Lecture)

Anil Kumar

- Presented progress in VI (XXXIV) Biennial Workshop of AICRP on Integrated Farming Systems held in virtual mode during December 15-18, 2020
- Research paper on Hybrid Approach for Modelling RNA-Seqdata (Mohammad Samir Farooqi*, K. K. Chaturvedi, D. C. Mishra, Sudhir Srivastava, Anil Rai, S.B. Lal, Anu Sharma and Anil Kumar) presented in National Seminar on Mathematical Sciences : Repositories of Logical Thoughts and Analytical Tools in Online National Seminar on "Mathematical Sciences: Repositories of Logical Thoughts and Analytical Tools" on December 22, 2020 organized By Department of Mathematics & Statistics COBS&H, CCS Haryana Agricultural University,Hisar

  * presented paaper

Arpan Bhowmik

- Chanda, B., **Bhowmik, A**., Jaggi, S., Varghese, E. and Datta, A. Cost and Trend Efficient 2^2 Factorial Designs for Agricultural Experiments Involving Hard to Change Factors. Paper presented by first author in Online National seminar on Mathematical Sciences: Repositories of Logical Thoughts and Analytical Tools on December 22, 2020.

PARTICIPATION IN TRAINING, WORKSHOP, SEMINAR, CONFERENCES, MEETINGS ETC.

Rajender Parsad, Susheel Kumar Sarkar and Sukant Dash

- International Conference on Importance of Statistics in Global Emerging Scenario in conjunction with 22nd Annual Conference of Society of Statistics, Computer and Applications held at Department of Statistics, Savitribai Phule Pune University, Pune during January 02-04, 2020.

Rajender Parsad

- ICPulse 2020: International Conference on Pulses, Climate Smart Crops: Challenges and Opportunities organized by Indian Society of Pulses Research and Development and ICAR-Indian Institute of Pulses Research at MP Tourism Development Corporation, Bhopal during February 10-12, 2020.

Sukanta Dash

- Participated one day workshop on "Sensitization on ICAR Data Management (ICAR Research Data Repository for Knowledge Management)" during February 7-8, 2020 at CSSRI, Lucknow.

- Participated two days' workshop on "Sensitization on ICAR Data Management (ICAR Research Data Repository for Knowledge Management)" during February 26-27, 2020 at CIRB, Hissar.

Arpan Bhowmik, Mohd. Harun

- दिनांक **20** मार्च **2020** को "**लाटेक के साथ शैक्षणिक लेखन**" पर एक पूर्ण दिवसीय हिन्दी कार्यशाला में भाग लिया जिसका आयोजन परीक्षण अभिकल्पना प्रभाग द्वारा किया गया था

Seema Jaggi, Rajender Parsad, Cini Varghese, B N Mandal, Sukanta Dash, Sunil Kumar Yadav, Mohd. Harun

- Participated in an online training on e-office organised by division of Computer Applications, ICAR-IASRI, New Delhi on 22.05.2020 afternoon

Seema Jaggi

- Participated in an **online** training workshop on **Training Management Information System (TMIS) and HRM Issues** conducted for HRD Nodal Officers of ICAR jointly by ICAR-IASRI and HRM Unit ICAR on May 8, 2020.
- Participated in a **Webinar on Sexual Harassment at Workplace: Challenges during Lockdown** on May 1, 2020 organized by Centre for Social Research (CSR), New Delhi.

Rajender Parsad

- Participated in Webinar on Science, Society and Exponential Change: Reimagining the Future on May 20, 2020. (Moderator: DDG (Agricultural Education); Chair: Secretary, DARE and DG, ICAR; Speaker: Dr. Pratibha Jolly, Former Principal, Miranda House, University of Delhi)
- Participated in Webinar on ICT Tools for the Resilient Agriculture Education in India on May 21, 2020. (Moderator: DDG (Agricultural Education).

Seema Jaggi

- Participated in a Webinar Series on **Be+ during Covid-19** during June 22-27, 2020 (4.00 pm – 5.30 pm) organized by IASRI under NAHEP through MS-Team.

- Attended the webinars of presentations by newly elected Fellows in the **Scientific Sessions** of the **Annual Programme** of National Academy of Agricultural Sciences (NAAS) during June 22 - 25, 2020.
- Attended the online meeting of the **NAAS Journal Score Committee (NJSC)** for revisiting the guidelines/proforma for evaluation of non-IF journals on June 30, 2020 through ZOOM video conferencing.

Rajender Parsad

- Online Experts Meet on ICAR-Geoportal Spatial Data Infrastructure and Applications -Way forward on June 2, 2020 organized by partner centre ICAR-NBSS&LUP, Nagpur.
- Webinar Panel Discussion on "Covid-19: Impacts and New Normal in Agriculture" organized by NAAS on June 5, 2020 (5:30 p.m. Indian time and 8:00 a.m. Washington DC, USA time) as part of Foundation Day of NAAS.

Mohd. Harun

- Attended a Webinar series on "Be+ during Covid-19" during June, 22-27, 2020 organised jointly by PIU, NAHEP andDivision of Computer Applications, ICAR-IASRI, New Delhi.

Seema Jaggi

- Participated in the online meeting on End-to-End user testing of DBT scheme AGEdn-IASRI Scholarship on July 6, 2020 and also the Demo of **Service Plus Software** for digitization on July 24, 2020.

Rajender Parsad

- Virtual launch of IFPRI South Asia Discussion of the 2020 Global Food Policy Report organized by IFPRI in collaboration with the Indian Council of Agricultural Research (ICAR) and the Trust for Advancement of Agricultural Sciences (TAAS), on July 6 from 4:30 pm – 6:00 pm IST to present the highlights of the report in South Asian context.
- Virtual Conference of ESRI User Conference India Live during July 14-16, 2020.

Cini Varghese and Mohd Harun

- Attended **IISA 2020 Student Paper Competition virtual presentations** on July 18, 2020 organised on *eventbrite* by International Indian Statistical Association.

Cini Varghese
Webinar

- **Attended** fourth national seminar on recent trends in statistical theory and applications-2020 [**NSSTA-2020**] organized during 29 June- 01 July 2020. It was organized by University of Kerala in connection with "National Statistics Day Celebrations 2020" and as a part of the "Platinum Jubilee Celebrations" of Department of Statistics, University of Kerala, Trivandrum, in association with Indian Society for Probability and Statistics(ISPS) and Kerala Statistical Association. There were 86 presentations spread over 16 sessions in 3 days.

Arpan Bhowmik

- Attended Webinar on "Sensitization on data upload and new functionalities in KRISHI" on 15/7/2020 through MS team platform.
- Attended the inaugural session of 28th Annual Review Workshop of AINP on Pesticide Residues as an special invitee through Zoom platform on 23/7/2020 where the website of AINP on Pesticide Residues was released by H'able DDG (CS), ICAR. **[Dr. Rajender Parsad and Dr. Arpan Bhowmik]**

- Attended AICRP-IFS (ON FARM) briefing meeting through Zoom platform on 23/7/2020 related to the presentation made by H'able Secretary, DARE and DG, ICAR in front of PMO. [**From ICAR-IASRI: Dr. Cini Varghese, Dr. Sukanta Dash, Dr. Arpan Bhowmik. Mr. Devendra Kumar and Sh. Rachit]**
- Attended "A one Day Online NAHEP Workshop for the Nodal Officers of Agricultural Universities organized under NAHEP - Component 2A subproject - "Investments in ICAR Leadership in Agricultural Higher Education" running in ICAR-IASRI, New Delhi on July 31st, 2020 through MS Team platform.

Seema Jaggi

- Participated as a Panelist in a **Webinar on New Education Policy in Agriculture Sector** on August 14, 2020 organized by IARI for faculty and students.

Rajender Parsad

- Virtual Brainstorming Workshop on **Identification of New Dimensions for Preparing National/Global Level Database on Women in Agriculture** organized at ICAR-Central Institute for Women in Agriculture, Bhubaneswar on August 28, 2020

B N Mandal

- Participated in two-days virtual workshop on "Long-Term Fertilizer Experiments: Achievements and Future Strategies" on 11-12 August, 2020. I have also presented the progress of IASRI center during 2017-20 on 12th August. The workshop was held on zoom platform.

- Participated in the webinar to celebrate the Inauguration of Academic and Administrative Building of Rani Lakshmi Bai Central Agricultural University, Jhansi" on 29th August, 2020 at 12:30 P.M by Honorable Prime Minister of India.

B N Mandal, Arpan Bhowmik

- Attended webinar on "New Education Policy in Agriculture" on August 14, 2020 organized by Post Graduate School, IARI.

Arpan Bhowmik

- Attended webinar on "ICAR Research Data Repository for Knowledge Management for ICAR-IIVR, Varanasi on August 06, 2020 through MS Team.
- Attended Virtual Interactive workshop on "ICAR Research Data Repository for Knowledge Management for NRC on Pig, Guwahati" on August 21, 2020 through MS Team
- Attended "A one Day Online NAHEP Workshop for the Nodal Officers of Agricultural Universities organized under NAHEP - Component 2A subproject - "Investments in ICAR Leadership in Agricultural Higher Education" running in ICAR-IASRI, New Delhi on July 31st, 2020 through MS Team platform

Anindita Datta

- Attended on-line Training Programme on "Analysis of Experimental Data using R" from 05-08-2020 to 11-08-2020 organized by ICAR-NAARM.

Dr. Seema Jaggi,

- Participated as a Panelist in a **Webinar on Farm Bills 2020** on September 26, 2020 organized by IARI for faculty and students.

- Participated as a Panelist in a **Webinar on Future Perspectives in Agricultural Education** by Dr. T. Mohapatra, DG ICAR during Teachers Dayon September 5, 2020 organized by IARI.
- Participated in the online meeting of the **NAAS Journal Score Committee (NJSC)**as member for finalizing the guidelines/proforma for evaluation of non-IF journals on September 22, 2020 through ZOOM video conferencing.

Rajender Parsad

- Virtual Symposium organized to celebrate the 100th Birthday of **Professor C. Radhakrishna Rao**, a living legend in the field of Statistics on September 09, 2020. The Department of Science and Technology, Government of India sponsored a formal felicitation for Professor Rao, acknowledging the extraordinary contributions he has made to the field of Statistics over the past seven decades. Following Speakers made presentations: (i) Rajeeva L. Karandikar**,** Director, Chennai Mathematical Institute; (ii) Katherine B. Ensor**,** Rice University, President Elect of the American Statistical Association; (iii) B.L.S. Prakasa Rao**,** Former Director, Indian Statistical Institute; (iv) Partha Pratim Majumder**,** President, Indian Academy of Sciences; (v) Shyamal D. Peddada**,** Senior Investigator and Branch Chief, Eunice Kennedy Shriver National Institute of Child Health and Human Development; (vi) James L. Rosenberger**,** Director, National Institute of Statistical Sciences; (vii) Simo Puntanen, Visiting Researcher, Tampere University and (viii) M.B. Rao, Professor, University of Cincinnati
- Workshop cum Training Programme on Intellectual Property Rights in Agricultural Research & Education in India Organized by NAHEP and IP&TM Unit, ICAR Hqrs., Pusa Campus, New Delhi during 12-28 September 2020.

Rajender Parsad, Arpan Bhowmik, Mohd. Harun

- **Birth Centenary Symposium on Contributions of Prof. CR Rao in Statistics** on September 15, 2020 at 3:00 PM organized at ICAR-IASRI, New Delhi

Cini Varghese

Felicitation attended

- Attended the online felicitation organized on the occasion of birth centenary of Padmavibhushan C. Radhakrishna Rao – a living legend in Statistics by DST on September 9, 2020. Eight eminent speakers honoured the occasion.

Arpan Bhowmik

- Attended webinar on "ICAR Research Data Repository for Knowledge Management for ICAR-CSWRI, Avikanagar on September 09, 2020 through MS Team.
- Attended "Teachers Day Lecture" at ICAR-IASRI through MS Team
- Attended webinar entitled “Future Perspectives in Agricultural Education” on September 5, 2020 organized by ICAR-IARI, New Delhi through Zoom Platform.

Rajender, Parsad, Seema Jaggi, Cini Varghese, B N Mandal, Sukanta Dash Arpan Bhowmik, Anindita Datta, Mohd. Harun

- Participated in the symposium on **Relevant and Quality Data for Agricultural Research and Policy Analysis** on October 20, 2020 organized by IASRI on the occasion of 3rd World Statistics Day.

Rajender, Parsad, Seema Jaggi, Cini Varghese, B N Mandal, Sukanta Dash Arpan Bhowmik, Anindita Datta, Mohd. Harun

- Participated in the celebration of Mahila Kisan Divas or the Day of Women Agriculturists by ICAR-IASRI, New Delhi on 15th October, 2020.

Sukanta Dash and Arpan Bhowmik

- Attended webinar on "ICAR Research Data Repository for Knowledge Management for ICAR-DGR, Junagarh on October 2, 2020 through Zoom Platform.

Rajender Parsad

- Workshop and Annual Review Meeting of ABIs/ ZTMCs/ ITMUs under ICAR institutes of NRM, Agricultural Engineering and Agricultural Education Divisions on November 23-24, 2020.
- Participated in the International Virtual Conference on Prof. CR Rao's School of Thought on Statistical Sciences organized by Department of Statistics, Pondicherry University, Pondicherry during 21st, 22nd, 28th & 29th of November.

B N Mandal

- Attended a **National Workshop on Intellectual Property Management in Agriculture** on 28th November, 2020 organized by ICAR-IIAB, Ranchi via Zoom.

Anindita Datta

- Attended 'Certificate Program in Data Analysis using Python' on 21st November, 2020.

Rjender Parsad

- Directors' conference organized virtually on December 05, 2020.
- Workshop on Response Surface and Mixture Experiment Methodologies for Agricultural and Fisheries Experimentation organized by ICAR-CMFRI, Kochi on December 16, 2020
- National Seminar on Mathematical Sciences: Repositories of Logical Thoughts and Analytical **Tools** for the Celebration of National Mathematics Day organized by Department of Mathematics and Statistics, CCSHAU, Hisar on December 22, 2020

Seema Jaggi

- Participated as Panelist in **Agricultural Education Day Celebration** on December 3, 2020 organized online by IARI. Agricultural Education Day lecture delivered by Dr. S.L. Mehta on Quality of Agricultural Education Holds the Key to Agricultural Transformation.
- Participated in the **XXVI Regional Committee V meeting** held online by IASRI on December 7, 2020.

Cini Varghese, Anil Kumar, Susheel K. Sarkar, Sukanta Dash, Arpan Bhowmik and Mohd, Harun

- Attended the VI (XXXIV) Biennial Workshop of **AICRP on Integrated Farming Systems** during 15-18 December 2020 through virtual mode (ZOOM).

Seema Jaggi, Cini Varghese, Susheel K. Sarkar, Sukanta Dash, Arpan Bhowmik, Anindita Datta, Mohd Harun,

- Participated in a workshop (virtual mode) on **Response Surface and Mixture Experiment Methodologies for Agricultural and Fisheries Experimentation** held by ICAR-CMFRI, Kochi on December 16, 2020.

Anil Kumar

- ऑन-लाईन हिन्दी कार्यशाला "कृषि जैव सूचना में टूल्स और तकनीकियों का अवलोकन" 14-16 दिसम्बर 2020
- International Seminar on National Education Policy (NEP) 2020: A Review held at Arya Kanya PG College, University of Allahabad, Allahabad, UP on 12th and 13th December 2020.

Arpan Bhowmik

- Attended **Agricultural Education Day Lecture on Quality of Agricultural Education holds the key to Agricultural Transformation** on December 03, 2020 through zoom platform. The lecture was organized by ICAR-IARI, New Delhi.

2. Division of Statistical Genetics

(i) Participation:

- Dr. Ranjit Paul Participated in one day International webinar on statistics and its application conducted on 08th August, 2020 by West Bengal State University, Kolkata.
  - **R.K. Paul**

- Dr. Ranjit Paul Participated in one week online faculty development program on recent advances in mathematics and statistics in connection with birth centenary of Prof. C. R. Rao jointly organized by department of mathematics, institute science and center for learning and sustainability, GITAM (Deemed to be university) Visakhpatnam, Andhra Pradesh, India during 03rd August to 08th August, 2020.
  - **R.K. Paul**

- Worked as Joint organizing secretary for organizing Global Conference on 'Emerging Agricultural Research to Endure the Predicament of COVID-19 Pandemic' during 12-13 December, 2020.
  - **R.K. Paul**

- Presented a lead talk on "The Impact of Covid-19 induced lockdown on wholesale and retail prices of Pulses in India" in Global Conference on 'Emerging Agricultural Research to Endure the Predicament of COVID-19 Pandemic' during 12-13 December, 2020.
  - **R.K. Paul**

- Co-chaired a technical session on "Containing Covid-19 Impact on Rural Economy: Challenges & Opportunities" of the Global Conference on 'Emerging Agricultural Research to Endure the Predicament of COVID-19 Pandemic' during 12-13 December, 2020.
  - **R.K. Paul**

- Attended a symposium on "Relevant and quality data for agricultural research and policy planning" which was organised at ICAR-IASRI, New Delhi, during 20 October, 2020 to celebrate the 3rd World Statistics day.
  - **P.K. Meher**

- Attended an International Workshop-training on "Designing and Implementing the Genomic Selection in Aquaculture" which was organised by ICAR-CIFE, Mumbai during 12-16 October, 2020.
  - **P.K. Meher**

- Attended "KBRIN 2019 Next Generation Sequencing and Bioinformatics Workshop" held on July 15 -19, 2019 at Bluegrass Community and Technical College in Lexington, Kentucky, USA in collaboration with University of Kentucky, Lexington, Ky, USA and sponsored by Kentucky Biomedical Research Infrastructure Network.
    - **Samarendra Das**

- Attended the workshop on "Use of reference management software like Endnote in research article writing" on August 1, 2019 held at Kornhauser Library, Health Sciences Campus, UofL.
    - **Samarendra Das**

- Attended Bioinformatics Core Workshop on High Throughput Sequence Analysis and Lessons Learned, Galt House Hotel, Louisville, Kentucky, USA on November 7, 2019.
    - **Samarendra Das**

- Attended Data Science workshop, Galt House Hotel, Louisville, Kentucky, USA on November 8, 2019.
    - **Samarendra Das**

- Attended and completed the (virtual) short course on "Introduction to RNA-seq analysis" organized by Basepairs on November 15, 2020.
    - **Samarendra Das**

- Attended a five-day international workshop-training conducted by the Director, CIFE, Mumbai on Designing and Implementing Genomic Selection in Aquaculture' from 12-16 October 2020 in online mode, under the aggies of NAHEP project 'Development of energy Efficient-----Soils.
    - **Himadri Shekhar Roy**

(ii) Paper presented in conference:

- International Conference on "Recent Advances in Statistics and Data Science for Sustainable Development" of Indian Society for Probability and Statistics held during December 21-23, 2019 at Utkal University, Bhubaneswar, India.

    - **Das, S.,** "Hybrid Statistical Approach for Selection of Biologically Relevant Genes using Gene Expression Data"

(iii) Poster Presentation

- 4th Annual Commonwealth Computational Summit, University of Kentucky, USA on October 15, 2020.

  - **Samarendra Das**
    "SwarnSeq: An Improved Statistical Approach for Differential Expression Analysis of Single-Cell RNA-Seq Data"

(iv) INVITED LECTURES/SEMINAR TALKS DELIVERED

R.K. Paul

- Delivered four invited talk on cointegration, ARIMAX model and ARFIMA model in the workshop on "Market Analytics using R-Phase II" organized at Anand Agricultural University, Gujarat during 2- 4 March, 2020.
- Delivered one lecture on "Time series models (Linear, nonlinear and hybrid)" on 10th June 2020 in webinar series "Quantitative Methods for Social Sciences" organized during 1st June to 23rd June 2020 by ICAR-NIAP, New Delhi.
- Delivered lecture on 'Basics of Statistics and SPSS application' in an International workshop on "Application of Statistics in Science and Technology using SPSS" organized by World Food Preservation Center, USA during August 8 to 10, 2020.

P.K. Meher

- Dr. Meher delivered invited lectures on two topics that are "Classification and regression by using Random Forest" and "Cluster analysis" in a webinar on "Machine Learning & Artificial Intelligence in Data Science (MAD 2020)", that was conducted by Department of Computer Science and Engineering, Jaypee Institute of Information Technology, Noida, during 08-12 June, 2020.

Samarendra Das

- Delivered a flash talk on "Statistical Approaches for Gene Set Analysis with Quantitative Trait Loci" in Bioinformatics session of the 2019 Southeast Regional IDeA Conference at Galt House Hotel, Louisville, Kentucky, USA on November 6, 2019.
- Delivered a short talk on "Statistical Approaches for Gene Set Analysis" in the Data science session of the 2019 Southeast Regional IDeA Conference at Galt House Hotel, Louisville, Kentucky, USA on November 7, 2019.

3. Forecasting and Agricultural Systems Modeling

a. Training(s) attended by the Scientists

- Dr. Shivaswamy G P attended a national online seminar on "Big data analytics in agriculture" organized by ICAR-NAARM, Hyderabad, during 10-11 December 2020.
- Dr. Anuja A R successfully completed the Massive Open Online Course on Designing E-Learning Content held during 01.07.2020 to 31.07.2020 conducted by ICAR-National

Academy of Agricultural Research Management, Hyderabad.

- Dr. Anuja A R and Dr. Ravindra Singh Shekhawat participated in तीन-दिवसीय हिंदी कार्यशाला "जीनोमिक आँकड़ों का विश्लेषण एवं उपयोगिता" (दिनाँक 24-26 सितम्बर 2020) organized virtually by the Centre for Agricultural Bioinformatics, ICAR- Indian Agricultural Statistics Research Institute, New Delhi.
- Dr Kanchan Sinha and Dr. HarishKumar H V participated in one day Hindi workshop on "Academic Writing with LATEX" on 20th march, 2020 at ICAR-IASRI, New Delhi.
- Dr. Achal Lama attended 2 weeks online Faculty Development Program on "Artificial Intelligence and Machine Learning Using Python" held during 13th to 24th July, 2020 organized by Finland labs in association with National Social Summit, IIT Roorkee.

b. Participation in the Meetings/Discussions/Presentation

a. Related to Projects

b. Related to Agricultural Statistics Systems

- Dr HarishKumar H V delivered lecture on "Linear and Integer Programming" and " "Structural break analysis with practicals" in ICAR Sponsored Winter School on "Recent Advances in Econometric Modeling and Forecasting in Agriculture" from 4th to 24th March 2020 at ICAR-IASRI, New Delhi.
- Dr. Rajeev Ranjan Kumar Participated in the symposium on "Relevant and quality data for agricultural research and policy planning" on the event on celebration of Third world statistics day on Oct. 2020, through online mode.
- Dr. Achal Lama Delivered 04 lectures on "ARCH and GARCH family of nonlinear time-series", "Multivariate time series Models", "Overview ARFIMA models" and "Bayesian approach for time series modeling" in Winter school on "Recent Advances in Econometric Modeling and Forecasting in Agriculture "from 04th to 24thMarch, 2020 at ICAR-IASRI, New Delhi.

c. Related to Teaching Activities

- Dr. Rajesh T delivered lecture on "Autoregressive and Distributed-Lag models with practical" in ICAR Sponsored Winter School on "Recent Advances in Econometric Modeling and Forecasting in Agriculture" from 4th to 24th March 2020 at ICAR-IASRI, New Delhi.
- Dr. HarishKumar H V attended BoS meeting of Division of Agricultural Economics, ICAR-IARI, New Delhi on 26th December to discuss about course structure and allotment of I semester, 2020-21.

- Dr. Rajeev Ranjan Kumar participated in the Teachers' Day Lecture to be delivered by Dr. Trilochan Mohapatra, Secretary (DARE) & DG (ICAR), New Delhi, on September 5, 2020 through Zoom webinar
- Dr. Rajeev Ranjan Kumar attended the Teachers day lecture organized by IASRI on September 5, 2020 through virtual mode on the topic New Education Policy.

d. Related to Administrative Activities

e. Related to Professional Society ISAS/SSCA

f. Miscellaneous

- Dr. Anuja A R and Dr. Shivaswamy G P organized a debate competition on 26.09.2020 as a part of the150th birth anniversary celebrations of Mahatma Gandhi Ji organized in ICAR- IASRI, New Delhi-12.
- Dr. Anuja A R acted as a member of the organising committee and event coordinator of the 150th birth anniversary celebrations of Mahatma Gandhi Ji organised in ICAR- IASRI, New Delhi-12.
- Dr. Rajesh T. deputed as Sector Officer for the Delhi Assembly Election 2020 in West Delhi, Assembly Constituency-27 from 05/12/2019 to 15/02/2020 and attended a series of meetings with AERO, Presiding Officers, Polling Officers, Sector Officers and SDM (Rajouri Garden) to have a discussion regarding smooth conducting of the election.
- Dr. Achal Lama, Dr. Anuja A R and Dr HarishKumar H V participated in the "inauguration of Academic and Administrative Building of Rani Lakshmi Bai Central Agricultural University Jhansi" virtually on 29th August, 2020.
- Dr. Achal Lama, Dr. Anuja A R, and Dr HarishKumar H V participated in the inauguration of KrishiMegh" ("NARES-Cloud Infrastructure and Services") virtually on 11th August, 2020.
- Dr HarishKumar H V and Dr. Achal Lama attended and participated in various meetings and activities of Swatchhata Pakhwada Celebrations (16.12.2020 to 31.12.2020) as a member.
- Dr. Achal Lama organized a visit to MNCFC, New Delhi to participants of Winter school on "Recent Advances in Econometric Modeling and Forecasting in Agriculture" from 04th to 24th March, 2020 at ICAR-IASRI, New Delhi.
- Dr. Ravindra Singh Shekhawat deputed as sector officer from 5th December, 2019 to 15th February, 2020 during Delhi Legislative Assemble election at Rajouri Garden (AC-27).
- Dr. Kanchan Sinha has attended Webinar on Discussion on New Education Policy on Aug 14, 2020 02:30 PM.

- Dr. Kanchan Sinha has attended meeting regarding Innovation Excellence Indicators (IEI) Framework Exercise through online by using Microsoft Team on 01.09.2020 and 22.09.2020
- Dr. Kanchan Sinha has attended Webinar on "Farm Bills 2020 on 26th September, 2020 at 3.00 p.m.
- Dr. Kanchan Sinha has attended the meeting on modalities regarding the courses of Agricultural Statistics and its distribution in different Semesters on 11-09-2020 at 12 noon.
- **Dr. Kanchan Sinha has attended the Special Lectures Session on Gandhian Philosophy on October 01, 2020 at 2 PM.**
- **Dr. Kanchan Sinha has attended the meeting of BoS Agricultural Statistics regarding** Course Distribution Semester 2020-21 on**3rd**October 2020 using Microsoft Teams
- Dr. Kanchan Sinha has attended pledge ceremony regarding Public Health Response to COVID-19 Campaign for COVID-19 - Appropriate Behavior on 9.10.2020.
- Dr. Kanchan Sinha has participated in the International Webinar on Application on Data Science and Applied Statistics organized by Society of Education and Council of Research and Sustainable Development on 21st May, 2020.
- Dr. Kanchan Sinha has attended the programme of World Food Day on 16th October virtually.
- Dr. Kanchan Sinha has attended the programme on Mahila Kisan Divas, virtually on October 15, 2020
- Dr. Kanchan Sinha has attended the programme of the third World Statistics Day on October 20, 2020.
- Dr. Kanchan Sinha has attended the online pledge ceremony on 27.10.2020 at 10.30 a.m. for Vigilance Awareness Week, 2020.
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- Anuja A R presented 'Pattern of crop diversification and its implications on under nutrition in India' in the 28th AERA annual conference on the theme "Future of Indian Agriculture: Challenges and Opportunities" to be held virtually during 16-18th December 2020 at University of Agricultural Sciences, Bengaluru.

- Anuja A R participated in the Online National Seminar on "Big Data Analytics in Agriculture" organized virtually by ICAR- NAARM during 10-11 December, 2020.

- Anuja A R participated in तीन-दिवसीय हिंदी कार्यशाला "जीनोमिक आँकड़ों का विश्लेषण एवं उपयोगिता" (दिनाँक 24-26 सितम्बर 2020) organized by the Centre for Agricultural Bioinformatics, ICAR- Indian Agricultural Statistics Research Institute, New Delhi.

- Anuja A R successfully completed the Massive Open Online Course on Designing E-Learning Content held during 01.07.2020 to 31.07.2020 conducted by ICAR-National Academy of Agricultural Research Management, Hyderabad.

- Anuja A R participated in the symposium on 'Relevant and Quality Data for Agricultural Research and Policy Planning organized by the ICAR-Indian Agricultural Statistics Research Institute, New Delhi to celebrate the 3rd World Statistics Day, 20th October, 2020 (virtual mode).

- Anuja A R registered and participated in the virtual Global Summit of Artificial Intelligence - Responsible AI for Social Empowerment RAISE 2020 from 5-9 October 2020 organized by Ministry of Electronics and Information Technology, Government of India.

- Anuja A R gave an invited talk on the topic "Crop Diversification towards high value crops for enhancing farm income during the COVID-19 Pandemic" in the national webinar on "COVID-19 Pandemic: Innovative Agri-Solutions in Vegetable Sector" organized by ICAR-Indian Institute of Vegetable Research, Varanasi on 03rd July, 2020.

- Anuja A R participated in the webinar organized by NAHEP (ICAR)- CAAST, IARI on "Future Perspectives in Agricultural Education" and attended lecture delivered by Dr. Trilochan Mohapatra, Secretary, DARE & Director General, ICAR, New Delhi on 5 September 2020.
- Anuja A R participated in the virtual program and webinar on 16th October, 2020 organized on the occasion of World Food Day and to celebrate 75th Anniversary of the Food and Agriculture Organization.
- Dr. Shivaswamy G P delivered an online lecture on the topic "Logit, Probit, and Tobit models" on June 3 in the webinar series on " Quantitative Methods for Social Sciences" organized by ICAR-NIAP from June 1 to June 23, 2020.

- Dr. Shivaswamy G P participated in the symposium on 'Relevant and Quality Data for Agricultural Research and Policy Planning' organized by the ICAR-Indian Agricultural Statistics Research Institute, New Delhi to celebrate the 3rd World Statistics Day (virtual mode) on October 20 2020.
- Dr. Shivaswamy G P participated in the 28th AERA annual conference on the theme "Future of Indian Agriculture: Challenges and Opportunities" held virtually during 16-18 December 2020 at the University of Agricultural Sciences, Bengaluru.

- Dr. Shivaswamy G P participated in the national online seminar on "Big data analytics in agriculture" organized by ICAR-NAARM, Hyderabad, during 10-11 December 2020.
- Dr. Kanchan Sinhaha participated in Be + webinar during 22nd to 27th June 2020, under the aegis of NAHEP organized by ICAR-IASRI.
- Dr. Kanchan Sinha has participated & submitted an abstract titled as **"**Grey System Theory Based Model Improved by Markov Chain: An Innovative Approach to Forecast Yearly Rice Production of Jharkhand" in a national level web based seminar on "Recent Trends in Statistical Theory and Application" organized by department of statistics, university of Kerala during 29th June to 01st July, 2020
- Dr. Md. Wasi Alam attended online meeting of "संस्थान राजभाषा कार्यान्वयन समिति" as assigned by Head of the Division, F&ASM.
- Dr. Md. Wasi Alam attended online celebration of International Women Day 8 March, 2021.
- Dr. Md. Wasi Alam attended ORW seminar of Mr. Kishor Pandurang Gavhane Ph.D., Roll No. 11648, Agricultural Engineering, IARI New Delhi.
- Dr. Md. Wasi Alam attended online Institute's Research Committee meeting.
- Dr. Md. Wasi Alam conducted online interactive session in orientation programme with the newly joined scientists at IASRI.
- Dr. Md. Wasi Alam joined training on e-office on 18/01/2021 at 12:00 AM through MS. Teams.
- Dr. Md. Wasi Alam attended online meeting with the farmers on the eve of Kisan Diwas on December 23, 2020.
- Dr. Md. Wasi Alam got registration and attended online Interaction of Hon'ble Prime Minister with the farmers and Release of next installment of PM – Kisan Samman Nidhi programme on 25.12.2020.
- Dr. Md. Wasi Alam participated in online inaugural function of "Academic and Administrative building of Rani Lakshmi Bai central agricultural university Jhansi" on 29th Aug 2020 online.
- Dr. Md. Wasi Alam attended online inaugural function of the "KrishiMegh" ("NARES-Cloud Infrastructure and Services") along with "Accreditation Portal" and "Alumni Network Portal" virtually on 11.08.2020 at 11:30am.
- Dr. Md. Wasi Alam attended various programmers' held during Hindi Pakwara week September 7-14, 2020.

- Dr. Md. Wasi Alam attended online Teacher's Day Lecture on "Future Perspectives in Agricultural Education" by Dr. Trilochan Mohapatra, Secretary, DARE & Director General, ICAR, New Delhi.
- Dr. Md. Wasi Alam took interactive lecture in online orientation training programme with newly recruited scientists who joined at IASRI in May, 2020.
- Dr. Md. Wasi Alam acted as an evaluator of course seminar entitled "*Detection of Influential Observation in High Dimensional Data Using LASSO Diagnostic"* for Raju Chaudhari, Ph,D.(Agricultural Statistics), Roll No: 11444.
- Dr. Md. Wasi Alam acted as an evaluator of course seminar entitled "*Asymmetric GARCH type of models for predicting volatility" for* Debopam Rakshit, Ph.D.(Agricultural Statistics), Roll No. 11437
- Dr. Md. Wasi Alam attended final viva-voce exam as a member of advisory committee of Mr. Saurav Kumar, M. Tech Scholar, Roll No.- 21070, Agricultural Engineering, IARI New Delhi.
- Dr. Md. Wasi Alam attended course seminar of his M.Sc. (Ag. Stat) student, Mr Praveen Kumar A, Roll No.-21241.
- Dr. Md. Wasi Alam attended viva-voce exam of his M.Sc. student, Mr. Rishabh Singh Shyam, Roll No.-21093, Agricultural Statistics.
- Dr. Md. Wasi Alam attended thesis seminar as an advisory committee member of Mr. RUPESH KUMAR (Roll No. 21078), Division of Engineering, IARI New Delhi on September 2, 2020.
- Dr. Md. Wasi Alam attended online prequalifying and / or qualifying viva-voce exam of the following three M.Sc. Students

  1. Mr. Saurav Kumar, Roll No.- 21070, Agricultural Engineering, IARI, New Delhi.
  2. Mr. Rupesh Kumar, Roll No.- 21078, Agricultural Engineering, IARI, New
  3. Mr. Rishabh Singh Shyam, Roll No.-21093, Agricultural Statistics, IARI, New Delhi

Dissertation approved for the following M.Sc. student of Dr. Wasi Alam:

Name of Student: Rishabh Singh Shyam

Degree of Discipline: Agricultural Statistics

Title: Development of Time Varying Smoothing Models

Name of Guide: Dr Md. Wasi Alam:

- WORKSHOPS/SEMINARS, SUMMER INSTITUTES, FARMERS 'DAYAND TRAINING PROGRAMMES ORGANISED.
- Dr. Kanchan Sinha Organized a "**Field Exposure Program**" from **17th January 2020 to 7th February, 2020** which is a part of MFSc curriculum of second year MFSc students of ICAR-Central Institute of Fisheries Education, Mumbai. There are a total of four students participating in this training program and two of them are associated with him. The name of MFSc students are Mr. Abhilash Thapa (FEC-MA-801) and Ms. Bethsy L. (FEC-MA-802).

During this training program following topics were covered under his guidance:

i. Introduction to R software with examples.
ii. Introduction to SPSS software with examples for data analysis.
iii. Descriptive statistics, Correlation
iv. Regression model and its application using R and SPSS software.
v. Time series, Components of time series, Moving Average model.
vi. Simple Exponential Smoothing, Holt method of exponential smoothing, Holt-Winters method of exponential smoothing and their application using time series data in R programming language.
vii. Auto Regressive Integrated Moving Average Model (ARIMA) and Its application for modelling and forecasting of time series data using R programming language.
viii. Vector Auto Regressive (VAR) model and its application for modelling and forecasting of time series data using R programming language.
ix. Cointegration and vector error correction model (VECM) and its application for modelling of time series data using R programming language.
x. Artificial Neural Networks (ANNs) and its application for modelling and forecasting of time series data using R programming language on different agricultural market dataset. The comparative performance of ANNs and regression model is also checked on different dataset involving dependent variables and list of independent variables.
xi. ARIMA Neural Network hybrid model for time series modelling and forecasting.

- Dr. Mrinmoy Ray, Shivaswamy G P and Dr. HarishKumar H V organized a ICAR Sponsored CAFT on "Statistical and Machine Learning Techniques for Modeling and Forecasting Agricultural Data" during 20thDecember, 2019 - 09thJanuary, 2020 under the aegis of Education Division, ICAR, New Delhi**.**

- Dr. Ravindra Singh Shekhawat, Dr. Anuja A. R. and Dr. Rajesh T. organized Winter School on "Recent Advances in Econometric Modeling and Forecasting in Agriculture" during 4-24 march,2020 at ICAR-IASRI, New Delhi under the aegis of Education Division, ICAR, New Delhi.

4. Division of Sample surveys

- Dr. Kaustav Aditya participated in the webnair entitled "Farm Bills 2020: Understanding the Implications" on Sep 26, 2020.
- Sh Deepak Singh gave oral presentation on the topic "Survey weighted agricultural consumption index" in the international conference on "Advances and Innovations in Agriculture & Allied Sciences (AIAAS-2020)" held during 31st January to 01st February, 2020 at Jawaharlal Nehru University (JNU), Convention Centre, New Delhi.
- Sh Deepak Singh gave oral presentation on the topic " An efficient family of ratio-product type estimator for finite population mean using auxiliary information" in the Sixth International Conference on Statistics for Twenty-first Century-2020 (ICSTC-2020) organized by the Department of Statistics, University of Kerala in association with American Statistical Association (ASA) and Kerala Statistical Association (KSA) held during 16-19 December, 2020.

- **Kumari, V.** and Chandra, H. "Estimation of Regression Coefficient for Sample Survey Data using Calibration Approach". **National Conference** on Contributions of Statistics to the Development of Society (**NCCSDS-2020**), February 7-8, 2020, Vikram University, Ujjain, Madhya Pradesh.

- **Kumari, V.**, Chandra, H. and Aditya, H. (2020). Estimation of Regression Coefficient from Survey Data using Calibration Approach by Borrowing Strength from Additional Auxiliary Variable. **International virtual conference on Advanced Statistical Techniques in Business and Industry,** A Regional Virtual Conference of International Society for Business and Industrial Statistics (ISBIS2020), CUSAT, Kerala, December 28-30, 2020.

8. PARTICIPATION IN CONFERENCES/WORKSHOPS/ SYMPOSIA

- Dr. Ankur Biswas attended 5th National Review Conference on Pradhan Mantri Fasal Bima Yojana (PMFBY) organized by Credit Division of Ministry of Agriculture & Farmers Welfare held on 27-28 November 2020 via Video Conference.

- Dr. Ankur Biswas attended a one day **Hindi Workshop** on "लाटेक के साथ शैक्षणिक लेखन" on March 20, 2020.

- Dr. Ankur Biswas attended one day **Inception Workshop** of the project *"Evaluation of Agricultural Census Scheme"* funded by Department of Agriculture Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India, New Delhi on March 13, 2020 at ICAR-IASRI, New Delhi to have a discussion on Evaluation of Improvement of Agricultural Statistics (IAS) Scheme with the concerned DES officials involved in the

scheme, officials from National Statistical Office (NSO), project team members and six identified experts.

- Dr. Ankur Biswas attended a **Workshop** organised under the project on "*Evaluation of Agricultural Census Scheme*" funded by Department of Agriculture Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India, New Delhi on December 21, 2020 (via online) as a **Co-PI** of the project.

- Dr. Ankur Biswas attended a **Workshop** under the project entitled "*Evaluation of Comprehensive Scheme for Studying Cost of Cultivation of Principal Crops*" funded by Directorate of Economics and Statistics, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India on **December 28, 2020** (via online) as a **Co-PI** of the project.

- Dr. Ankur Biswas attended Birth Centenary **Symposium** on Contributions of Prof. C.R. Rao in Statistics on September 15, 2020 (via online).

- Dr. Ankur Biswas participated in a **Symposium** on *"Relevant and Quality Data for Agricultural Research and Policy Planning"* under the Chairmanship of Shri Pravin Srivastava, Former Chief Statistician of India and Secretary, Ministry of Statistics & Programme Implementation, Government of India organized at ICAR-IASRI, New Delhi on October 20, 2020 to celebrate the 3rd World Statistics Day (via online).

- Dr. Ankur Biswas attended online training on e-office (e-file) on May 22, 2020 organized by Computer Applications Division through Microsoft Teams App.

- Dr. Ankur Biswas attended Teachers' Day Lecture of ICAR-IASRI delivered by Dr. RC Agrawal, DDG (Education) ICAR on "New Education Policy" on September 5, 2020 at 3.00 pm through virtual mode.

- Dr. Ankur Biswas attended Teachers' Day Lecture of ICAR-IARI delivered by Dr. Trilochan Mohapatra, Secretary (DARE) & DG (ICAR), New Delhi on September 5, 2020 at 11.00 AM through Zoom webinar.

- Dr. Ankur Biswas attended Daroga Singh smriti bhyakhyan organized on the occasion of the Valedictory programme of Hindi Week on September 14, 2020.

- Dr. Ankur Biswas attended the Special Lectures Session on Gandhian Philosophy organized on October 01, 2020 as part of week-long celebrations culminating in 150th Birth Anniversary of Mahatma Gandhi. I have also attended the Concluding Session of the Week long Celebrations during 25 September – 01 October, 2020 held on 2nd October 2020.

- Dr. Ankur Biswas attended the online Webinar on the occasion of World Food Day and 75th Anniversary of the Food and Agriculture Organization where Hon'able Prime Minister of Govt. of India will release a Commemorative Coin on 16th October, 2020.

- Dr. Ankur Biswas attended video conference telecast of Global Potato Conclave organized at Mahatma Mandir, Gandhinagar, Gujarat on 28th January 2020 in which the Hon'ble Prime Minister will be the Chief Guest. This telecast was organized at our Institute at 10.30 a.m. on 28th January, 2020.

- Dr Raju Kumar participated in one-day Inception Workshop at ICAR-IASRI, New Delhi on 6th March, 2020 for a project "Evaluation of Improvement of Agricultural Statistics Scheme" funded by Directorate of Economics & Statistics, Department of Agriculture Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India.

- Dr Raju Kumar participated a workshop in online mode under the project entitled "Evaluation of Comprehensive Scheme for Studying Cost of Cultivation of Principal Crops" on December 28, 2020 funded by Directorate of Economics and Statistics, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India.

- Dr Raju Kumar participated a workshop in online mode under the project entitled "Evaluation of Agricultural Census Scheme" on December 21, 2020 funded by Directorate of Economics and Statistics, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India.
- Dr Vandita Kumari participated in the National Conference on Contributions of Statistics to the Development of Society (NCCSDS-2020) held during February 7-8, 2020 at Vikram University, Ujjain, Madhya Pradesh.

- Dr Vandita Kumari participated in the International virtual conference on Advanced Statistical Techniques in Business and Industry, A Regional Virtual Conference of International Society for Business and Industrial Statistics (ISBIS2020), held during 28-30 December 2020 in Conjunction with Silver Jubilee Anniversary of Department of Statistics, Cochin University of Science and Technology (CUSAT), Kerala.

- Dr Vandita Kumari participated in 5 days International Webinars on "Cryptography and its applications" organised during August 26-30, 2020 by Department of Statistics, West Bengal State University, IAI, TCG CREST and Indian Statistical Institute, Kolkata.

- Dr Vandita Kumari attended webinar on "New Education Policy (NEP)" in Agriculture Sector on August 14, 2020.

- Dr Vandita Kumari participated in Webinar by NHEP(ICAR)-CAAST, IARI on "Future Perspective in Agricultural Education" organized by ICAR-IARI on September 5, 2020.

- Dr Vandita Kumari attended "Birth Centenary Symposium on Contributions of Prof. CR Rao in Statistics" on September 15, 2020 at ICAR-IASRI.

- Dr Vandita Kumari participated in Webinar Series on Be+ during COVID 19 organised during June 22 -27, 2020.
- Dr Bharti participated in हिन्दी कार्यशाला" कृषि जैव सूचना में टूल्स और तकनीकियों का अवलोकन"
- Dr Bharti participated in a workshop on Evaluation of Agricultural Census Scheme

- Dr Bharti participated **in a workshop on Evaluation of Comprehensive Scheme for Studying Cost of Cultivation of Principal Crops**
- Dr Bharti attended closing workshop on "**Evaluation of Improvement of Agricultural Statistics Scheme**"and **"Evaluation of Comprehensive Scheme for Studying Cost of Cultivation of Principal Crops" on 23.03.2021.**
- Sh Rahul Banerjee attended a three days Hindi On-Line Workshop "Overview of Tools and Techniques in Agricultural Bioinformatics" during 14-16 December, 2020 organized by Centre for Agricultural Bioinformatics, ICAR-Indian Agricultural Statistics Research Institute, New Delhi.

PARTICIPATION IN MEETINGS

- Dr. Ankur Biswas attended a Video Conferencing meeting on the project "*Intergrated Sample survey Solution for major Livestock products*" with all State/UTs on January 10, 2020 at Krishi Bhawan.

- Dr. Ankur Biswas attended Executive Council meeting of Indian Society of Agricultural Statistics (ISAS) under the chairmanship of Dr. Padam Singh, Executive President of the Society on January 25, 2020 at ICAR-IASRI, New Delhi.

- Dr. Ankur Biswas attended Technical Advisory Committee (TAC) meeting for resolution of dispute on claim payment under WBCIS in Kharif 2013 season under PMFBY under the chairmanship of CEO, PMFBY on February 20, 2020 at Krishi Bhawan, New Delhi.

- Dr. Ankur Biswas attended a meeting under the project *"Evaluation of Improvement of Agricultural Statistics Scheme"* under the chairmanship of Director, ICAR-IASRI with DES officials including Sh. P.R. Meshram, Adviser Statistics, Deputy Director and others in order to discuss the work plan and other important aspects (as Co-PI of the project) on March 6, 2020 at ICAR-IASRI, New Delhi.

- Dr. Ankur Biswas attended a Meeting to discuss formulating risk wise indicator matrix and thresholds for enabling a Technology Driven Two-Step Yield Estimation Approach to conduct need based Crop Cutting Experiments (CCEs) under PMFBY under the Chairmanship of Dr. Ashish Kumar Bhutani, CEO-PMFBY, DAC&FW on March 16, 2020 at Krishi Bhawan, New Delhi.

- Dr. Ankur Biswas attended the Meeting of Sub-Group of the Technical Advisory Group (TAG) for Agriculture Statistics to discuss on revised schedules for ICS Scheme on March 17, 2020 at NSO (FOD) Headquarters, Sankhyiki Bhawan, New Delhi.

- Dr. Ankur Biswas attended a Video Conferencing meeting under the Chairmanship of Dr. Ashish Kumar Bhutani, JS(Credit), CEO-PMFBY, DAC&FW to discuss Technology based Crop Yield Estimation Approach under PMFBY for Rabi 2019-20 as alternative to incomplete CCE/poor quality CCE data due to lock-down situation in the country on April 10, 2020.

- Dr. Ankur Biswas attended an online meeting on Foundation Day Lecture on "Evolution of Space based Crop Forecasting" by Dr Vinay Kumar Dadhwal, Director, Indian Institute of Space Science & Tech. and Former Director, NRSC & IIRS on April 23, 2020 organised by Mahalanobis National Crop Forecast Centre, Department of Agriculture, Coop. & Farmers' Welfare, New Delhi.

- Dr. Ankur Biswas interacted and conducted orientation Training Programme of Newly joined ARS Scientist posted at ICAR-IASRI, New Delhi by online meeting by MS Teams on May 19, 2020.

- Dr. Ankur Biswas attended the Second Video Conferencing meeting under the Chairmanship of Dr. Ashish Kumar Bhutani, JS(Credit), CEO-PMFBY, DAC&FW to discuss preparation of protocol for implementation of Technology Driven Two Step Yield Estimation Approach to conduct need based CCEs under PMFBY on May 27, 2020.

- Dr. Ankur Biswas attended Video Conference meeting to review the progress of the project *"Evaluation of Improvement of Agricultural Statistics Scheme"* under the Chairmanship of Sr.ESA, DES, DAC&FW on June 03, 2020.

- Dr. Ankur Biswas attended Board of Studies (BOS) for the Discipline of Agricultural Statistics on July 06 and 22, 2020.

- Dr. Ankur Biswas attended an online meeting of all scientists and technical personnels of the Institute held on July 20, 2020 under the Chairmanship of DDG (Education), ICAR to review the activities, progress and various action points of ICAR-IASRI through Video-Conferencing.

- Dr. Ankur Biswas a**ttended inaugural function of the "Krishi Megh" i.e. "NARES-Cloud Infrastructure and Services", "Accreditation Portal" and "Alumni Network Portal" on August 11, 2020 organized online by PIU, NAHEP and ICAR-IASRI. Honourable Union Minister of Agriculture and Farmers Welfare and Minister of Rural Development & Panchayati Raj, Shri Narendra Singh Tomar ji inaugurated these programmes.**

- Dr. Ankur Biswas attended online meeting of faculty members of Agricultural Statistics discipline to discuss on shifting from Trimester to Semester System for the students being admitted in PG School ICAR-IARI from 2020-21 following the Dean's committee recommendations on September 11, 2020.

- Dr. Ankur Biswas attended a virtual meeting under the chairpersonship of DG (Statistics), NSO, Ministry of Statistics and Programme Implementation (MoSPI) to discuss the strategy for development & compilation of SDG indicators relating to FAO on October 29, 2020.

- Dr. Ankur Biswas attended Technical Evaluation committee's meeting for Technical evaluation of e-tender for hiring of services for supervising and/or conducting Crop Cutting

Experiments (CCEs) in Agriculture field on October 19, 2020 at Mahalanobis National Crop Forecast Centre (MNCFC), New Delhi as nominated by Director, ICAR-IASRI.

- Dr. Ankur Biswas attended a meeting on the project *"Evaluation of Comprehensive Scheme for Studying Cost of Cultivation of Principal Crops"* with Ms. Ruchika Gupta, Advisor, DES Advisor, DES via online mode on December 14, 2020.

- Dr. Ankur Biswas attended the House Allotment Committee meeting at ICAR-IASRI on January 14, February 18, November 27 and December 31, 2020 as a member of the committee.

- Dr. Ankur Biswas attended and evaluated Qualifying Viva-voce Examination of Mr. Nobin Chandra Paul on September 15, 2020 via online mode.

- Dr. Ankur Biswas attended and evaluated Qualifying Viva-voce Examination of Mr. Rajeev Kumar, Roll no. 10587, Ph.D. (Agricultural Statistics) on 18th December, 2020 via online mode.

LECTURE DELIVERED

- Dr. Ankur Biswas delivered lectures on *"Elementary Concepts in Sample Surveys and Sample Selection Procedures under Simple Random Sampling", "Sampling Technique–I: Stratified Random Sampling, PPS Sampling and Systematic Sampling" and "Demonstration of Data Analysis Software under CHAMAN"* in the Training Programme on "Sampling Techniques on Crop Cutting Experiment" during January 06-10, 2020 at ICAR-IASRI.

- Dr. Ankur Biswas delivered lectures on *"PPS Sampling with Practical Example"* on August 21, 2020 through online mode in the training programme on "Data Analysis and Interpretation" held for the Indian Statistical Service probationers of the Ministry of Statistics & Programme Implementation, Govt. of India during 17th -28th August 2020 at ICAR-IASRI.

- Dr. Ankur Biswas delivered lectures on *"PPS Sampling with Practical Example"* on September 18, 2020 through online mode in the training programme on "Data Analysis and Interpretation" held for the Indian Statistical Service probationers of the Ministry of Statistics & Programme Implementation, Govt. of India during 14-25 September, 2020 at ICAR-IASRI.

- Dr Raju Kumar delivered lectures on the topics "Inferential Statistics", "ANOVA" and "Non Parametric test" on 23rd January, 2020 at SK Rajasthan Agricultural University, Bikaner in the training programme entitled "Tools and Techniques for Data Analysis and Management" organized by Institute of Agri Business Management, SK Rajasthan Agricultural University, Bikaner during January 20-25, 2020.

- Dr Vandita Kumari Prepared the lecture notes and delivered lecture on Hands on Exercises on Different Sampling Design on Jan 07, 2020 for the training programme on "Sampling Technique for Crop Cutting Experiment (CCE)" conducted during Jan 06-10, 2020.

- Dr Vandita Kumari Prepared the lecture notes and delivered four lectures on various topics in the training programme on "Data Analysis and Interpretation" conducted during August 17-28, 2020.

- Dr Vandita Kumari Prepared the lecture notes and delivered five lectures on various topics in the training programme on "Data Analysis and Interpretation" conducted during September 14-25, 2020.

- Sh Deepak Singh participated in one-day Inception Workshop at ICAR-IASRI, New Delhi on 6th March, 2020 for a project "Evaluation of Improvement of Agricultural Statistics Scheme" funded by Directorate of Economics & Statistics, Department of Agriculture Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India.

- Sh Deepak Singh participated a workshop in online mode under the project entitled "Evaluation of Comprehensive Scheme for Studying Cost of Cultivation of Principal Crops" on December 28, 2020 funded by Directorate of Economics and Statistics, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India.

- Sh Deepak Singh participated a workshop in online mode under the project entitled "Evaluation of Agricultural Census Scheme" on December 21, 2020 funded by Directorate of Economics and Statistics, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India.

5. Division of Computer Applications

PAPER PRESENTED:

- Sapna Nigam presented a paper titled 'Plant Disease Identification in Wheat using Deep Learning ((#ICAFS98765)' in 2020 International Conference on Agricultural and Food Science during October 28-30, 2020 through online mode.

INVITED LECTURES/ SEMINAR TALKS DELIVERED:

- Dr. Mukesh Kumar delivered an invited talked on "Information Technology Interventions in Physiological and Postural Ergonomics Assessment to Combat Drudgery" in International Conference on "Importance of Statistics in Global Emerging Scenario Agriculture (ISGES-2020)" during 02 – 04 January 2020 in conjunction with the XXII Annual Conference of the Society of Statistics, Computer and Applications (SSCA) at Department of Statistics at Savitribai Phule Pune University, Ganeshkhind, Pune.

- Dr. Shashi Dahiya delivered a lecture and demonstration on TMIS in the 1 Day online workshop on "Training Management Information System (TMIS) for HRD Nodal Officers of ICAR" on 08th May, 2020.

- Ms. Sapna Nigam delivered two online lectures on "Introduction to Deep Learning " and "Deep Learning: A practical approach" in 5 days online Faculty Development Program on artificial Intelligence during May 25-29, 2020 organized by Department of Computer science & Applications, Dr. Harisingh Gour University, Sagar , Madhya Pradesh.

- Dr. Sudeep delivered a talk on 'ICAR Databases' in the 9-week workshops on 'Online Session for Startups' organized by Pusa Krishi, ICAR-IARI on 17th August, 2020.
- Dr. Sudeep delivered a lecture on 'IT Applications of ICAR' in the training program of "Data Analysis and Interpretation" on 17th August, 2020 for the Indian Statistical Service probationers of the Ministry of Statistics & Programme Implementation, Govt. of India.
- Dr. Sudeep delivered a e-Talk on 'KVK Portal and Mobile Apps' in an online program on 'Digital Platforms for Effective Outreach' on 29th August 2020.
- Dr. Shashi Dahiya delivered a lecture on 'Data Mining-An Overview, Feature Selection and Performance Evaluation' in the 10 days Training on "Data Science in Agriculture Using R" organized by ICAR-IASRI under NAHEP during 7th September to 18th September' 2020 through online mode.
- Dr. Alka Arora delivered a lecture on 'Cluster Analysis using R' in the 10 days Training on "Data Science in Agriculture Using R" organized by ICAR-IASRI under NAHEP during 7th September to 18th September' 2020 through online mode.
- Dr. Anshu Bharadwaj delivered a lecture on 'Association Rule Mining using R' in the 10 days Training on "Data Science in Agriculture Using R" organized by ICAR-IASRI under NAHEP during 7th September to 18th September' 2020 through online mode.
- Dr. Soumen Pal delivered two lectures on 'Overview on R software and RStudio' and 'Data Visualization using R' in the 10 days Training on "Data Science in Agriculture Using R" organized by ICAR-IASRI under NAHEP during 7th September to 18th September' 2020 through online mode.
- Dr. Alka Arora delivered a talk on "Knowledge Management System for DUS Characteristics" in an international webinar on "DUS testing data management/Automation/Image Analysis" on 6-7th Oct. 2020
- Dr. Alka Arora delivered a talk " Clustering Applications in Agriculture" in the webinar series "Quantitative Methods for Social Sciences" organized by NIAP, New Delhi.
- Mr. Samarth Godara delivered a lecture on "Machine Learning Models", in the course on "AI for BFSI" organized by IIT Roorkee with WileyNXT during 19th September 2020 to 20th January' 2021 through online mode.

PARTICIPATION IN CONFERENCES/WORKSHOPS

- Dr. Sudeep and Dr. Shashi Dahiya participated in 1 Day online workshop on "Training Management Information System (TMIS) for HRD Nodal Officers of ICAR" on 8th May, 2020.
- Dr. Alka Arora and Dr. Anshu Bharadwaj participated in the Microsoft Envision Forum on 15th May, 2020, conducted by Microsoft and have been awarded the Digital Badge for AI Business School for completing AI Business School from Microsoft India.
- Dr. Anshu Bharadwaj participated in the SAS Global Forum's Executive Connection, a complimentary event organized by SAS Inc. on 19th May, 2020.

- Dr. Anshu Bharadwaj attended the Webinar on "ICT Tools for the Resilient Agriculture Education in India" on 21st May, 2020 organised by NAHEP.
- Dr. Anshu Bharadwaj attended the half a day online training programme on e-office on 22nd May, 2020
- Dr. Soumen Pal participated in the Webinar on "e-Education in Agricultural Sciences in the age of Social Distancing: Opportunities, Challenges and Strategies" organized by Assam Agricultural University under NAHEP on 5th June, 2020 through online mode.
- Dr. Anshu Bharadwaj attended a webinar on 'ARCGIS Enterprise-Introduction' organised by ESRI, India on 5th June 2020 through online mode.
- Dr. Anshu Bharadwaj attended a Webinar on "Industry 4.0: The Role of AI and Data Science" organized by BPIT, New Delhi on 15th June 2020.
- Mr. Samarth Godara attended online course on 'Convolutional Neural Networks' during organized by deeplearning.ai 09th June, 2020 to 07th July, 2020.
- Mr. Samarth Godara attended online course on 'Improving Deep Neural Networks Hyperparameter tuning, Regularization and Optimization' organized by deeplearning.ai during 10th June to 1st July, 2020 through online mode.
- Dr. Mukesh Kumar participated in the FFP Annual Review workshop during June 17-18 2020 through online mode.
- Dr. Shashi Dahiya, Dr. Soumen Pal, Dr. Mukesh Kumar, Dr. S.N Islam, Mr. Pal Singh, Dr. Chandan Kumar Deb, Md. Ashraful Haque, Sanchita Naha and Sapna Nigam participated in the webinar series on "Be+ during Covid-19" organized by ICAR-IASRI under NAHEP during 22-27 June, 2020 through online mode.
- Mr. Samarth Godara attended online course on 'Structuring Machine Learning Projects' organized by deeplearning.ai during 19th June to 3rd July, 2020 through online mode.
- Mr. Samarth Godara attended online course on 'Sequence Models' organized by deeplearning.ai during 16th June, 2020 to 07th July, 2020 through online mode.
- Dr. Alka Arora and Dr. Anshu Bharadwaj participated in a training program on "Stress Management" organised by NAARM, Hyderabad during July 7-9, 2020 through online mode.
- Dr. Anshu Bharadwaj Attended Sensitization Webinar of KRISHI organized by ICAR-IASR on 10th July, 2020.
- Dr. Anshu Bharadwaj attended a conference on 'ESRI Virtual User Conference 2020' organised by ESRI, India during 13-16 July 2020 through online mode.
- Md. Ashraful Haque, Sanchita Naha and Madhu Dahiya participated in a faculty development program on 'Machine Learning' organized by Jagan Institute of Management Studies, Rohini in association with CSI Delhi Chapter during 13th July to 17th July, 2020 through online mode.
- Mr. Samarth Godara attended online course on 'Red Hat Summit Virtual Experience: Open House' organized by deeplearning.ai on 15th July, 2020 through online mode.

- Dr. Sudeep , Dr. Alka Arora, Dr. Shashi Dahiya, Dr. Anshu Bharadwaj and Dr. Soumen Pal participated in a faculty development program on 'Artificial Intelligence and Machine Learning using Python' Organized by, Finland Labs (A Unit of Revert Technology Pvt. Ltd.)In Association with National Social Summit, IIT Roorkee during July 13-24, 2020 through online mode.
- Dr. Anshu Bharadwaj and Dr. Soumen Pal attended an one Day Online NAHEP Workshop for the Nodal Officers of Agricultural Universities on 31st July, 2020, thorugh online mode.
- Dr. Shashi Dahiya attended the webinar on "Discussion on New Education Policy" organized by IARI, New Delhi on 14th August, 2020 through online mode.
- Md. Ashraful Haque attended a national webinar on 'Abiotic Stress in Agriculture: Geospatial Characterization and Management Options' organised by ICAR-NIASM on 27th August 2020 through online mode.
- Dr. Anshu Bharadwaj Attended Technical Workshop "Improving Higher Agriculture Education Job Outcomes in India: Challenges and Opportunities" on 3rd September 2020.
- Dr. Sudeep , Dr. Alka Arora, Dr. Anshu Bharadwaj, Dr. Shashi Dahiya, Dr. Soumen Pal, Dr. Mukesh Kumar, Mr. S.N Islam, Mr. Pal Singh, Dr. Chandan Kumar Deb, Md. Ashraful Haque, Sanchita Naha, Ms. Madhu, Samarth Godara and Sapna Nigam attended the Birth Centenary Symposium on Contributions of Prof. CR Rao in Statistics. Prof. R.B. Singh was the Chairperson the session. Four Eminent Statisticians have given a talk on this occasion on September 15, 2020 started at 3:00 PM through online mode.
- Dr. Sudeep attended a national online webinar on 'Farm Bills 2020' on 26th September, 2020.
- Dr. Sudeep attended an online webinar on 'XII Dr. S. Pradhan Memorial Lecture' on 28th September, 2020.
- Ms. Sapna Nigam participated in an International Conference on Agricultural and Food Science-2020 (4th ICAFS2020), Istanbul–Turkey during October 28-30, 2020 through online mode.
- Dr Shashi Dahiya participated in an International virtual conference on Prof. C.R. Rao's School of Thought on Statistical Sciences organized by the Deptt. of Statistics Pondicherry University and Mrs. A.V.N College, Vishakhapatnam during 28-29 November' 2020 virtually.
- Dr. Anshu Bharadwaj Attended the virtual workshop on "Data Science for agriculture and Natural Resource Management" as a part of International Conference on Big Data Analysis (BDA 2020) on 16th December 2020.
- Dr. Sudeep and Dr. Alka Arora attended the Annual workshop of Nodal Officer of Agricultural Universities on 8th May 2020 in the chairmanship of DDG(Education), ICAR.

MEETINGS

- Dr. Alka Arora and Soumen Pal attended CSISA Review Meeting at IIWBR, Karnal on 4th January, 2020.

- Dr. S.N. Islam attended a meeting at IVRI, Barelly under the chairmanship of Dr Triveni Dutt JD, Academics and Dean IVRI, Barelly regarding the development of the AI based mobile App.
- Dr. Alka Arora attended the meeting with DDG(Engg.) and ADG(ICT) for finalization of proceedings of HYPM.
- Dr. Soumen Pal attended a meeting related to "Precision Agriculture" on 17th February, 2020 at CABin division of ICAR-IASRI, New Delhi.
- Dr. Sudeep , Dr. Alka Arora and Dr. Soumen Pal attended online meeting with ADG (Ag. Extension), ADG (ICT), ATARI Directors and other Principal Scientists of Ag. Extension Division regarding future roadmap of KVK Mobile App under the chairmanship of DDG (Ag. Extension) on 4th May, 2020.
- Dr. Alka Arora and Dr. Soumen Pal attended online meeting with ADG (ICT) regarding feedback proforma of KVK Portal and KVK Mobile App on 16th May, 2020.
- Dr. Sudeep , Dr. Soumen Pal and Sapna Nigam attended online meeting with ADG (Education), NIC Team and Service Plus Team regarding scope of Service Plus System for end-to-end implementation of DBT Schemes of DARE on 21st May, 2020.
- Dr. Sudeep , Dr. Alka Arora and Dr. Soumen Pal attended the meeting with NIC officials for discussion on Service Plus was held on 21st May 2020.
- Dr. Alka Arora and Dr. Soumen Pal attended online meeting with Secretary, ICAR and ADG (ICT) regarding ICT initiatives of ICAR on 22nd May, 2020.
- Dr. Sudeep , Dr. Alka Arora, Dr. Soumen Pal and Ms. Sanchita Naha attended online meeting with JS (IT&Policy), DAC&FW regarding reporting of KKA III Activities and Dashboard in KVK Portal on 26th May, 2020.
- Dr. Sudeep , Dr. Soumen Pal and Sapna Nigam attended the meeting with ADG (EP&HS), Dr. Nidhi Verma (Principal Scientist (EP&HS)) and Service Plus Team regarding Service Definer Guide of Service Plus, an integrated eService Delivery Framework at KAB II on 27th May, 2020.
- Dr. Alka Arora attended the meeting with Additional Secretary (DARE) & Secretary (ICAR) on 29th May to present the HYPM/ARMS System.
- Dr. Sudeep , Dr. Soumen Pal and Sapna Nigam attended online meeting regarding Service Definer Guide of Service Plus with ADG (EP&HS) and Dr. Nidhi Verma (Principal Scientist (EP&HS)) on 30th May, 2020.
- Dr. Anshu Bharadwaj attended Virtual Meeting of Experts on "ICAR-KRISHI Geoportal Spatial Data Infrastructure and Applications–Way forward" organised by ICAR-NBSS&LUP, Nagpur on 2nd June, 2020
- Dr. Anshu Bharadwaj attended Advisory committee meeting in online mode of a Ph.D student to finalize his thesis in view of the submission.
- Dr. Sudeep and Dr. Alka Arora attended meeting with VC/Dean of Universities for features on MS-Team organized by Education Division on 2nd June 2020.
- Dr. Anshu Bharadwaj attended online video meeting of Farmers First Project with the project team.
- Dr. Sudeep , Dr. Alka Arora, Dr. Anshu Bharadwaj and Dr. Soumen Pal attended NAHEP online Review Meeting under the chairmanship of DDG(Education) and ND (NAHEP) on

Alumni Network and Accreditation Portal and presented the demonstration of Accreditation Portal on 3rd June, 2020.

- Dr. Sudeep , Dr. Soumen Pal and Sapna Nigam attended Online meeting under the chairmanship of ADG(EP&HS) to discuss on Service Definer Guide (SDG) of Service Plus for end-to-end digitization of DBT applicable schemes of DARE on 19th June, 2020.
- Dr. Sudeep , Dr. Alka Arora and Dr. Soumen Pal attended NAHEP online Review Meeting under the chairmanship of DDG(Education) and ND (NAHEP) on Alumni Network, Accreditation Portal and University Ranking.
- Dr. Anshu Bharadwaj attended a meeting with ESRI India, NBPGR and IASRI for discussion on revamping of PGR Clim Application hosted on KRISHI- Geoportal on 22nd June 2020.
- Dr. Alka Arora attended a meeting for Revision of Proforma for Ranking of ICAR Universities in the chairmanship of DDG(Education) and ND(NAIP) on 24th June 2020.
- Dr. Sudeep , Dr. Soumen Pal and Sapna Nigam attended Online meeting under the chairmanship of ADG(EP&HS) to discuss on technical details of Service Plus System for end-to-end digitization of DBT applicable schemes of DARE on 24thJune, 2020.
- Dr. Sudeep , Dr. Alka Arora and Dr. Soumen Pal attended Online meeting with CIMMYT team regarding discussion on Cereal Systems Initiative for South Asia (CSISA); presented dashboard developed under CSISA project for rice crop on 29th June, 2020.
- Dr. Sudeep , Dr. Soumen Pal and Sapna Nigam attended online meeting under the chairmanship of ADG(EP&HS) to discuss on Service Plus System for end-to-end digitization of DBT applicable schemes of DARE on 6th July, 2020.
- Dr. Anshu Bharadwaj Attended Partners Meet of KRISHI in online video mode to discuss and finalize the way forward .
- Dr. Sudeep , Dr. Alka Arora, Dr. Soumen Pal and Ms. Sanchita Naha attended online meeting with officials of different departments under Ministry of Agriculture & Farmers Welfare regarding Key Performance Indicators (KPIs) of different activities to be captured in KVK Portal under Krishi Kalyan Abhiyaan (KKA) – III on 7th July, 2020.
- Dr. Sudeep , Dr. Alka Arora and Dr. Anshu Bharadwaj attended meeting for review for establishment of DR Center on 11th July 2020 in the chairmanship of DDG (Edu.) and ND (NAHEP) with NC (NAHEP Comp-II) and project team HITACHI, ICAR-NAARM Project team.
- Dr. Alka Arora attended online meeting under the chairmanship of DDG (Education) for designing the proforma for Ranking of University System was held on 15th July, 2020.
- Dr. Sudeep , Dr. Alka Arora and Dr. Anshu Bharadwaj attended an online meeting regarding the DR Center on 17th July 2020.
- Dr. Alka Arora and Dr. Soumen Pal attended online meeting with CIMMYT team along with ATARI Directors and KVKs regarding discussion on Cereal Systems Initiative for South Asia (CSISA) on 17th July, 2020 regarding the dashboard developed under CSISA project for rice crop.
- Dr. Sudeep and Dr. Alka Arora attended online LMS workshop for Agricultural Universities in ICAR on 18th July, 2020 under the chairmanship of DDG (Education).
- Dr. Anshu Bharadwaj attended a meeting with DDG (Edu.) and ND (NAHEP) on 20th July 2020.

- Dr. Sudeep, Dr. Alka Arora, Dr. Soumen Pal and Ms. Sanchita Naha attended online meeting with officials of different departments under Ministry of Agriculture & Farmers Welfare regarding Key Performance Indicators (KPIs) of different activities to be captured in KVK Portal under Krishi Kalyan Abhiyaan (KKA) – III on 23rd July, 2020.
- Dr. Sudeep, Dr. Soumen Pal and Sapna Nigam attended Online meeting under the chairmanship of ADG(EP&HS) on User Acceptance Testing (UAT) for IASRI Scholarship Scheme configured in Service Plus System on 24th July, 2020.
- Dr. Sudeep, Dr. Alka Arora Dr. Soumen Pal and Ms. Sanchita Naha attended Online meeting with officials of different departments under Ministry of Agriculture & Farmers Welfare regarding Key Performance Indicators (KPIs) of different activities to be captured in KVK Portal under Krishi Kalyan Abhiyaan (KKA) – III on 29th July, 2020.
- Dr. Alka Arora and Dr. Soumen Pal attended Online meeting under the chairmanship of Secretary, ICAR regarding future roadmap of Ag. Extension activities with presence of DDG (Ag. Extension), ADG (Ag. Extension), ADG (ICT) and ATARI Directors on 29th July, 2020;in this meeting, demonstrated KVK Portal to the Secretary, ICAR.
- Dr. Sudeep attended an online meeting with DDG (Ag. Ext.) regarding KVK portal and Kisan Sarathi Program on 29th July, 2020.
- Dr. Anshu Bharadwaj attended a meeting of KRISHI with DC Team, and Project team on 30th July 2020.
- Dr. Sudeep attended an online meeting regarding Transfer Policy/Guidelines for Scientists of ICAR on 1st August, 2020.
- Dr. Sudeep, Dr. Soumen Pal and Sapna Nigam attended online meeting along with representatives from ICAR-IARI, ICAR-NDRI and ICAR-CIFE under the chairmanship of ADG (EP&HS) to discuss on implementation of DBT applicable schemes of DARE using ServicePlus System for end-to-end digitization on 5th August, 2020.
- Dr. Sudeep and Dr. Alka Arora attended the meeting to review the progress of ARMS system under the chairmanship of Secretary (ICAR) and ADG(ICT) on 5th August 2020.
- Dr. Alka Arora and Dr. Soumen Pal attended online meeting with ADG (Ag. Extension) and other officials regarding Key Performance Indicators (KPIs) in ICAR Dashboard on 17th August, 2020.
- Dr. Alka Arora and Dr. Soumen Pal attended online meeting along with DDG (Ag. Extension), ADG (Ag. Extension), ADG (ICT), CEO (CSC) and other officials under the chairmanship of Secretary (ICAR) regarding MoU between ICAR and Common Service Centre (CSC) on 18th August 2020.
- Dr. Alka Arora and Dr. Soumen Pal attended a review meeting for discussion on KPI's for Prayas dashboard with DDG(Extension) and ADG(ICT) on 21st August 2020.
- Dr. Sudeep and Dr. Alka Arora attended committee meeting as member for assessment promotion of technical officer at ICAR-National Research Center for Integrated Pest Management on 1st September 2020.
- Dr. Anshu Bharadwaj Attended the meeting with ESRI to discuss and resolve the pending issues related to GIS server environment on 3rd and 4th September 2020.
- Dr. Soumen Pal attended online meeting for discussion on 'IT intervention in extension' under the chairmanship of DDG (Extn.) on 4th September, 2020.

- Dr. Sudeep, Dr. Soumen Pal and Sapna Nigam attended Online meeting under the chairmanship of ADG (EP&HS) regarding issues in configuration of DBT applicable schemes of DARE through Service Plus on 14th September, 2020.
- Dr. Anshu Bharadwaj Attended the Steering Committee Meeting of KRISHI on 24th September 2020.
- Dr. Sudeep , Dr. Alka Arora, Dr. Anshu Bharadwaj, Dr. Shashi Dahiya, Dr. Soumen Pal, and Dr. S.N Islam attended online meeting of the Advisory Committee of NAHEP Component 2 Project "Investment in ICAR Leadership in Agricultural Higher Education" chaired by ND, NAHEP on 26th September, 2020.
- Dr. Sudeep attended an online meeting of National Organizing Committee of Kritagya Hackathon on 5th October, 2020.
- Dr. Sudeep , Dr Alka Arora and Dr. Shashi Dahiya attended meeting of Experiential Learning Coordinators of SAUs organized by Education Division, ICAR on 6th Oct 2020 and made the presentation on ELP.
- Dr. Sudeep attended an online meeting of National Organizing Committee of Kritagya Hackathon on 10th October, 2020.
- Dr Alka Arora attended an online meeting regarding Query resolution on Agricultural University Ranking System (AURS) with university VCs, Registrars and Nodal Officers under the chairmanship of DDG (Education) on 12th October, 2020.
- Dr. Sudeep attended an online meeting of National and Zonal Organizing Committee of Kritagya Hackathon on 12th October, 2020.
- Dr. Sudeep attended an online meeting with Hon'ble VCs, Registrars, and nodal officers for the demo of Accreditation portal on 12th October, 2020
- Dr. Alka Arora and Dr. Soumen Pal attended online meeting with e-Governance Cell of ICAR regarding integration of KVK Portal parameters with DARPAN digital dashboard on 13th October, 2020.
- Dr. Sudeep attended NAHEP External Advisory Panel Meeting on 13th October, 2020 organized by ICAR-NAARM Hyderabad.
- Dr. Sudeep attended an online meeting of National Steering Committee and National Organizing Committe of KRITAGYA Hackathon under the chairmanship of Secretary, DARE and D. G., ICAR on 21st October, 2020
- Dr. Alka Arora and Dr. Soumen Pal attended Online meeting with e-Governance Cell of ICAR and NIC regarding Web API level integration for ICAR DARPAN digital dashboard on 22nd October, 2020.
- Dr. Sudeep , Dr. Alka Arora, Dr. Soumen Pal and Ms. Sanchita Naha attended Online meeting related to KKA III dashboard with stakeholders from different divisions from Ministry of Agriculture & Farmers Welfare on 28th October, 2020
- Dr. Sudeep attended the NAHEP review meeting through online mode on 2nd November, 2020.
- Dr. Sudeep attended an online review meeting of the Organizing Committee of Kritagya Hackathon on 11th November, 2020.
- Dr. Sudeep , Dr. Soumen Pal and Sapna Nigam attended online meeting with Deemed Universities' Directors/Nodal Officers related to end to end digitisation of the Direct Benefit

Transfer (DBT) schemes through ServicePlus under the chairmanship of ADG (EP&HS) on 25th November, 2020.

- Dr. Sudeep and Dr. Shashi Dahiya attended the online Vice Chancellors and Director's Meeting regarding E-Learning Activity with the DDG (Edu.) on 4th December, 2020.
- Dr. Anshu Bharadwaj Attended the XXVI Meeting of ICAR Regional Committee-V on 7th December 2020.
- Dr. Sudeep attended Meetings of National Organizing/ Evaluation committee of KRITAGYA Hackathon during December 14-16, 2020.

Chapter 12
Conferences, Workshops, Meetings and Seminars organized

Anshu Bharadwaj and Rajender Parsad

- Webinar on "Sensitization on Data Upload and New Functionalities on KRISHI Portal" on July 15, 2020.

Arpan Bhowmik and Rajender Parsad

- Virtual Sensitization Workshop on ICAR Research Data Repository for Knowledge Management for ICAR-DMAPR, Anand on July 10, 2020.

B N Mandal

- One day Hindi workshop on "Academic writing with LATEX" at our institute on 20 March, 2020.

Cini Varghese

- Online Digital Shodh Poster Pratiyogita at our institute on September 10, 2020

Deepak Singh

- "Kisan Diwas" as Co-organiser on December 23, 2020 in the institute.

Kaustav Aditya

- One day workshops of the project entitled "Evaluation of the Agricultural Census Scheme" on January31, 2020 and on December 21, 2020 (as Co-PI).

K.K.Chaturvedi

- Three days Hindi Workshop "कृषि जैव सूचना में टूल्स और तकनीकियों का अवलोकन" in the institute during 14-16 December 2020.
- Meeting with Bioinformatics Group, C-DAC Pune to discuss about the workflow/pipelines development in ANVAYA and its installation in HPC cluster of ASHOKA of our institute on October 06, 2020.

Md. Samir Farooqi

- Organized three days Hindi Workshop "कृषि जैव सूचना में टूल्स और तकनीकियों का अवलोकन" during 14-16 December 2020 in the institute as workshop co-coordinator.

Mukesh Kumar and Rajender Parsad

- Webinar on "ICAR Research Data Repository for Knowledge Management" for ICAR-Central Institute of Fisheries Education, Mumbai on October 21, 2020 (with Subodh Gupta)

Rajender Parsad

- Webinar session on Implementation of ICAR Research Data Management Guidelines on March 23, 2020.
- Virtual Interactive Workshop on ICAR Research Data Repository for Knowledge Management for NRC on Pig, Guwahati on August 21, 2020. (with N.H. Mohan)
- Organised 29th Dr Daroga Singh Memorial Lecture and Hindi Diwas on September 14, 2020.
- Webinar on "ICAR Research Data Repository for Knowledge Management" for ICAR-Directorate of Groundnut Research, Junagarh on October 27, 2020 (with Kona Praveen).

Rajender Parsad, Anil Kumar, Mukesh Kumar, Anshu Bharadwaj, Susheel Kumar Sarkar, Arpan Bhowmik and Sukanta Dash

- A sensitization seminar on ICAR Research Data Repository for Knowledge Management at Division on Agronomy, ICAR-IARI, New Delhi on January 20, 2020.

Rajender Parsad and Arpan Bhowmik

- "Sensitization Webinar on KRISHI portal for Scientific and Other Staff of ICAR-DMAPR, Anand" on 10 July, 2020.

Rajender Parsad, Hukum Chandra and Ajit

- Symposium on Relevant and Quality Data for Agricultural Research and Policy Planning at ICAR-IASRI, New Delhi on the occasion of 3rd World Statistics Day on October 20, 2020.
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Rajender Parsad, Seema Jaggi, Anshu Bharadwaj and Shashi Dahiya

- Mahila Kisan Diwas or Women Farmers Day on women's critical role and significant contributions in agriculture, food and nutrition security and income generation at our institute on October 15, 2020.

Rajender Parsad, Ajit, Ramasubramanian V., Anshu Bharadwaj, Prawin Arya and Susheel Kumar Sarkar

- Organized XXVI meeting of ICAR Regional Committee-V on December 07, 2020 (Virtual Mode)

Seema Jaggi

- Annual Day Function of the institute in online mode on July 02, 2020.
- Meeting of Standing Committee on Faculty and Discipline of PG School IARI on July 18, 2020.

Seema Jaggi and B N Mandal

- Coordinated orientation training in Design of Experiments Division for newly joined scientists during May 13-16, 2020.

Seema Jaggi and Cini Varghese

- **Birth Centenary Symposium on Contributions of Professor C.R. Rao in Statistics** as Convener on September 15, 2020.

Sukanta Dash and Arpan Bhowmik

- One day workshop on "Sensitization on ICAR Data Management (ICAR Research Data Repository for Knowledge Management)" at CSSRI, Lucknow during February 07-08, 2020.

Sukanta Dash, Mukesh Kumar and Susheel Kumar Sarkar

- Two days workshop on "Sensitization on ICAR Data Management (ICAR Research Data Repository for Knowledge Management)" at CIRB, Hisar during February 26-27, 2020.

Susheel Kumar Sarkar and Rajender Parsad

- Virtual Interactive Workshop on ICAR Research Data Repository for Knowledge Management for ICAR-CSWRI, Avikanagar on September 09, 2020 (with Banwari Lal).

Sudeep Marwaha and Shashi Dahiya

- One Day online workshop on "Training Management Information System (TMIS) for HRD Nodal Officers of ICAR" on May 08, 2020 (with A.K Vyas and Navin Jain)

Shashi Dahiya and Sudeep Marwaha

- One day Online e-Learning Review Workshop for 'Call 1' Nodal Officers/ Deans under the NAHEP - Component 2A subproject - "Investments in ICAR Leadership in Agricultural Higher Education" on July 31, 2020.
- Seven day Online e-Learning Review Workshop for selected 'Call 1' faculty and Nodal Officers of 22 AU's under the NAHEP - Component 2A subproject- "Investments in ICAR Leadership in Agricultural Higher Education" during November 23-30, 2020.

S.B. Lal, Md. Samir Farooqi and K.K. Chaturvedi

- Hindi Workshop on "संगणक एवं सांख्यिकीय तकनीकों का कृषि जैव सूचना में प्रयोग" in the institute during March 05-07, 2020.

Vandita Kumari

- Inception workshop under the project "Evaluation of Agricultural Census Scheme" on January 31, 2020.

Chaper 11

भा.कृ.अनु.प.–भारतीय कृषि सांख्यिकी अनुसंधान संस्थान में हिन्दी के प्रगामी प्रयोग की रिपोर्ट

भा.कृ.अनु.प.–भारतीय कृषि सांख्यिकी अनुसंधान संस्थान में राजभाषा हिन्दी के प्रगामी प्रयोग में सतत् अभिवृद्धि हो रही है । संस्थान द्वारा समस्त प्रशासनिक कार्य शत–प्रतिशत हिन्दी में और यथाआवश्यक द्विभाषी हो रहा है । राजभाषा नीति को संस्थान में सुचारु रूप से कार्यान्वित किया जा रहा है । भारत सरकार, गृह मंत्रालय, राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम में निहित लक्ष्यों को संस्थान में लगभग पूरा कर लिया गया है ।

संसदीय राजभाषा समिति की दूसरी उप–समिति द्वारा 31 अक्टूबर 2020 को संस्थान का राजभाषा सम्बन्धी निरीक्षण किया गया । निरीक्षण के दौरान समिति सदस्यों ने संस्थान की राजभाषा सम्बन्धी प्रगति की समीक्षा की तथा हिन्दी की उत्तरोत्तर प्रगति के लिए कुछ सुझाव देते हुए संस्थान में हिन्दी में हो रहे कार्यों की सराहना की ।

प्रतिवदेनाधीन अवधि के दौरान संस्थान के विभिन्न वर्गों के कर्मियों के लिए छः हिन्दी कार्यशालाएँ ऑन–लाइन आयोजित की गयीं । पहली कार्यशाला जनवरी–मार्च 2020 तिमाही के दौरान 05–07 मार्च, 2020 को संस्थान के कृषि जैव सूचना केन्द्र के अध्यक्ष, डॉ. अनिल राय द्वारा ''संगणक एवं सांख्यिकीय तकनीकों का कृषि जैव सूचना में अनुप्रयोग'' विषय पर आयोजित की गयी । इस कार्यषाला में 11 अधिकारियों एवं 01 कर्मचारी द्वारा सहभागिता की गयी । दूसरी कार्यशाला 20 मार्च, 2020 को संस्थान के परीक्षण अभिकल्पना प्रभाग के वैज्ञानिक डॉ. बी.एन. मंडल द्वारा ''लाटेक के साथ शैक्षणिक लेखन'' विषय पर आयोजित की गयी । इस कार्यषाला में 21 अधिकारियों एवं 02 कर्मचारियों द्वारा सहभागिता की गयी । तीसरी कार्यशाला अप्रैल–जून 2020 तिमाही के दौरान 22 मई 2020 को संस्थान के संगणक अनुप्रयोग प्रभाग के अध्यक्ष, डॉ. सुदीप मारवाह एवं श्री आर. के. सैनी, मुख्य तकनीकी अधिकारी द्वारा ''ई–आफिस में फाइल प्रबन्धन प्रणाली'' विषय पर आयोजित की गयी । इस कार्यषाला में 61 अधिकारियों एवं 19 कर्मचारियों द्वारा सहभागिता की गयी । चौथी कार्यशाला जुलाई–सितम्बर 2020 तिमाही के दौरान 24–26 सितम्बर, 2020 को संस्थान के कृषि जैव–सूचना केन्द्र के वैज्ञानिक, डॉ. मीर आसिफ इकबाल एवं डॉ. सारिका द्वारा ''जीनोमिक आँकड़ों का विश्लेषण एवं उपयोगिता : एक अवलोकन'' विषय पर आयोजित की गयी । इस कार्यषाला में 09 अधिकारियों द्वारा सहभागिता की गयी । पॉचवी कार्यशाला अक्टूबर–दिसम्बर 2020 तिमाही के दौरान 09 अक्टूबर 2020 को संस्थान के सूचना प्रौद्योगिकी प्रकोष्ठ के प्रधान वैज्ञानिक,

डॉ. मुकेश कुमार एवं श्री राकेष कुमार सैनी, मुख्य तकनीकी अधिकारी द्वारा ''ई–आफिस में फाइल प्रबन्धन प्रणाली'' विषय पर आयोजित की गयी । इस कार्यषाला में 11 अधिकारियों एवं 19 कर्मचारियों द्वारा सहभागिता की गयी । छठी कार्यशाला अक्टूबर–दिसम्बर 2020 तिमाही के दौरान 14–16 दिसम्बर 2020 को संस्थान के कृषि जैव–सूचना केन्द्र के वैज्ञानिक, डॉ. सुधीर श्रीवास्तव, डॉ. के.के चतुर्वेदी एवं डॉ. मो. समीर फारूकी द्वारा ''कृषि जैव सूचना में टूल्स और तकनीकियों का अवलोकन'' विषय पर ऑन–लाइन आयोजित की गयी । जिसमें संस्थान के 06 अधिकारियों के अतिरिक्त पहली बार भारतीय कृषि अनुसंधान परिषद के अन्य 12 संस्थानों के (08 राज्यों) से 11 अधिकारियों एवं 04 कर्मचारियों द्वारा सहभागिता की गयी । इस कार्यशाला में आयोजकों द्वारा ब्रोचर हिन्दी भाषा में उपलब्ध करायी गयी।

संस्थान में प्रशासनिक कार्य के साथ–साथ वैज्ञानिक प्रकृति के कार्यों में भी हिन्दी का उपयोग हो रहा है । संस्थान के वैज्ञानिक प्रभागों द्वारा आयोजित प्रशिक्षण कार्यक्रमों की संदर्भ पुस्तिकाओं में कवर पेज, आमुख एवं प्राक्कथन द्विभाषी रूप में प्रस्तुत करने के साथ–साथ कुछ हिन्दी के व्याख्यान भी शामिल किये गये। वैज्ञानिकों द्वारा अपनी परियोजना रिपोर्टों में कवर पेज, आमुख, प्राक्कथन एवं सारांश द्विभाषी रूप में प्रस्तुत किये गये । संस्थान के वैज्ञानिकों द्वारा हिन्दी में वैज्ञानिक विषयों पर हिन्दी कार्यशालाओं का आयोजन किया गया तथा कार्यषालाओं के मैनुअल/प्रषिक्षण सामग्री हिन्दी में तैयार की गयी। इसके अतिरिक्त, संस्थान में एम.एससी. तथा पीएच.डी. के विद्यार्थियों द्वारा अपने शोध–प्रबन्धों में सार द्विभाषी रूप में प्रस्तुत किये गये । वैज्ञानिकों एवं तकनीकी कर्मियों द्वारा शोध–पत्र हिन्दी में प्रकाषित किये गये।

प्रतिवेदनाधीन अवधि में संस्थान में राजभाषा कार्यान्वयन समिति जनवरी–मार्च, 2020 तिमाही की बैठक कोविड–19 महामारी की वजह से लगे देषव्यापी लॉक–डाउन के कारण 09 जून, 2020 को ऑन–लाइन आयेजित की गई तथा अप्रैल–जून, 2020 तिमाही की बैठक 28 अगस्त, 2020 को ऑन–लाइन आयोजित की गई । शेष 02 तिमाहियों बैठकें निर्धारित समय में ऑन–लाइन आयोजित की गयी । इन बैठकों में राजभाषा अधिनियम, 1963 की धारा 3(3) के अनुपालन को सुनिश्चित करने, राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम की विभिन्न मदों, राजभाषा विभाग एवं परिषद् मुख्यालय से समय–समय पर प्राप्त निदेशों का अनुपालन सुनिश्चित करने, कार्यशालाओं के नियमित आयोजन, हिन्दी पत्रिका के प्रकाशन, हिन्दी सप्ताह के आयोजन इत्यादि पर विस्तार से चर्चा हुई ।

राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम में निहित लक्ष्यों को पूरा करते हुए संस्थान के अधिकारियों/कर्मचारियों द्वारा समस्त पत्राचार हिन्दी में अथवा द्विभाषी रूप में किया गया । संस्थान के विभिन्न वैज्ञानिक प्रभागों तथा प्रशासनिक अनुभागों द्वारा आयोजित बैठकों की कार्यसूची तथा कार्यवृत्त शत–प्रतिशत हिन्दी में अथवा द्विभाषी रूप में जारी किये गये । संस्थान में अपना कार्य शत–प्रतिशत हिन्दी में करने के लिए 12

अनुभागों को विनिर्दिष्ट किया गया है । गृह मंत्रालय, राजभाषा विभाग द्वारा जारी विभिन्न नकद पुरस्कार योजनाएँ संस्थान में लागू हैं ।

संस्थान में कार्यरत सभी हिन्दीतर अधिकारियों/कर्मचारियों द्वारा हिन्दी ज्ञान सम्बन्धी प्रशिक्षण पूरा किया जा चुका है । आज तक की स्थिति के अनुसार, संस्थान में अब कोई ऐसा हिन्दीतर अधिकारी/कर्मचारी शेष नहीं रह गया है जिसे हिन्दी ज्ञान सम्बन्धी प्रशिक्षण दिया जाना शेष हो ।

इसके अतिरिक्त, 'हिन्दी शिक्षण योजना' के अन्तर्गत हिन्दी आशुलिपि के प्रशिक्षण का लक्ष्य पूरा है अभी तक हिन्दी टंकण के प्रशिक्षण का लक्ष्य भी पूरा था परन्तु दिसम्बर 2018 से संस्थान में नव–नियुक्त अवर लिपिकों में से 02 अवर लिपिकों द्वारा टंकण परीक्षा उत्तीर्ण कर ली गयी है एवं 01 अवर लिपिक की परीक्षा होनी शेष है तथा 02 अवर लिपिकों द्वारा 'हिन्दी शिक्षण योजना' के अन्तर्गत अगस्त 2020 से आरम्भ सत्र में हिन्दी टंकण प्रशिक्षण पा रहें 02 अवर लिपिकों का परीक्षा परिणाम आना शेष है तथा 02 नव–नियुक्त कनिष्ठ लिपिक हिन्दी टंकण के प्रशिक्षण के लिये शेष हैं । राजभाषा विभाग से प्राप्त दिशा–निर्देशों के अनुसरण में वर्ग 'घ' से वर्ग 'ग' में गये कर्मियों में से वर्ग 'ग' श्रेणी के लिए निर्धारित शैक्षिक योग्यता रखने वाले कर्मियों को रोस्टरबद्ध कर उनमें से एक कर्मी हिन्दी शिक्षण योजना के अन्तर्गत जुलाई 2019 से आरम्भ सत्र में हिन्दी टंकण का प्रशिक्षण के लिए भेजा गया था । उनकी परीक्षा का परिणाम अनुर्तीण रहा है इनके द्वारा पुनः टंकण परीक्षा (आगामी) दी जाएगी ।

संस्थान की वेबसाइट पर 'हिन्दी सेवा लिंक' उपलब्ध है । जिसमें सांख्यिकी एवं प्रषासनिक शब्दावली के वर्ण क्रमानुसार कुछ शब्द, कुछ द्विभाषी प्रपत्र, दैनिक काम–काज के प्रयोग में आने वाली कुछ टिप्पणियाँ, द्विभाषी पदनाम, वाक्यांष इत्यादि सामग्री उपलब्ध है । संस्थान के कर्मियों द्वारा अपना दैनिक कार्य हिन्दी में सरलता से करने के लिए इस सेवा का उपयोग किया जाता है ।

संस्थान द्वारा प्रकाषित हिन्दी पत्रिका, 'सांख्यिकी–विमर्श' के पंद्रहवां अंक का प्रकाशन मार्च 2020 में किया गया । इस पत्रिका में संस्थान में सम्बन्धित वर्ष में किये गये अनुसंधानों व अन्य कार्यों के संक्षिप्त विवरण, राजभाषा से सम्बन्धित कार्यों आदि की जानकारी के साथ–साथ कृषि सांख्यिकी, संगणक अनुप्रयोग एवं कृषि जैव सूचना से सम्बन्धित विभिन्न लेखों एवं शोध–पत्रों को भी प्रस्तुत किया गया है। पाठकों के हिन्दी ज्ञानवर्धन के लिए दैनिक स्मरणीय शब्द–शतक हिन्दी व अँग्रेजी में दिया गया है ।

संस्थान में 07 से 14 सितम्बर 2020 के दौरान हिन्दी सप्ताह का आयोजन किया गया । कोविड–19 महामारी के कारण इस वर्ष अधिकांष कार्यक्रम/प्रतियोगितायें ऑन–लाइन आयांजित की गयीं। दिनांक 07 सितम्बर, 2020 को हिन्दी सप्ताह का उद्घाटन संस्थान के तत्कालीन निदेशक, डॉ. तौकीर अहमद जी द्वारा किया गया । हिन्दी सप्ताह के उद्घाटन के पश्चात 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, डिजिटल षोध पोस्टर प्रस्तुति, हिन्दीतर कर्मियों के लिए हिन्दी श्रुतलेख एवं शब्दार्थ लेखन प्रतियोगिता आयोजित की गयी। 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 उन्तीसवां व्याख्यान भारतीय कृषि अनुसंधान परिषद के उपमहानिदेशक (षिक्षा), डॉ. आर.सी. अग्रवाल जी द्वारा ''राष्ट्रीय कृषि संबंधी उच्च षिक्षा'' विषय पर दिया गया और इस कार्यक्रम की अध्यक्षता भारतीय चिकित्सा अनुसंधान परिषद के पूर्व अपर महानिदेशक एवं राष्ट्रीय सांख्यिकीय आयोग के पूर्व सदस्य, डॉ. पदम सिंह जी द्वारा की गयी । दिनांक 14 सितम्बर, 2020 को हिन्दी सप्ताह के समापन समारोह के अवसर पर इस दौरान आयोजित प्रतियोगिताओं के सफल प्रतियोगियों को पुरस्कृत करने के साथ–साथ वर्ष 2019–20 के दौरान ''सरकारी कामकाज मूल रूप से हिन्दी में करने के लिए प्रोत्साहन योजना'' के अन्तर्गत नकद पुरस्कारों की घोषणा भी की गयी। इसके अतिरिक्त, जुलाई 2019 से सितम्बर, 2020 तक की अवधि के दौरान संस्थान में आयोजित हिन्दी कार्यशालाओं के वक्ताओं की भी घोषणा की गयी ।

LIST OF RESEARCH PROJECTS

1st January to 31st December, 2020

DEVELOPMENT AND ANALYSIS OF EXPERIMENTAL DESIGNS FOR AGRICULTURAL SYSTEMS RESEARCH

On-going

Institute Funded

1. Analytical procedure for factorial experiments with Logistic and Gompertz error distributions. (AGEDIASRISIL201701300099)
   Sunil Kumar Yadav: 25.05.2017-30.04.2020

Outside Funded

2. ICAR Research Data Repository for Knowledge Management as KRISHI: Knowledge based Resources Information System Hub for Innovations in Agriculture. Under ICAR Headquarter Plan Scheme (2015-2020). (AGENIASRICOL201503100068)
   ICAR-IASRI: Rajender Parsad, AK Choubey (till 20.01.2018), Anil Kumar, Mukesh Kumar, Anshu Bharadwaj, Susheel Kumar Sarkar, Arpan Bhowmik, Raju Kumar (till 04.06.2017), Vandita Kumari Choudhary (till August 2016) and Sukanta Dash (since 03.04.2017)
   ICAR-NAARM: A Dhandapani
   ICAR-NBSS&LUP: GP Obi Reddy, Nirmal Kumar and Sudipto Chattaraj
   ICAR-IARI: Vinay Kumar Sehgal and Joydeep Mukerjee
   ICAR-DKMA: Mitali Ghosh Roy
   ICAR-CMFRI: J Jayasankar
   ICAR-CRIDA: NS Raju, P Vijaya Kumar (since 17.12.2017), AVM Subba Rao (since 17.12.2017): 24.07.2015-31.03.2021
3. Planning, designing and analysis of experiments planned on stations under All India Coordinated Research Project on Integrated Farming Systems. Funded by AICRP on IFS, IIFSR, Modipuram. (AGEDIASRISOL201701900105)
   Anil Kumar, Md. Harun, Susheel Kumar Sarkar and Eldho Varghese (upto 22.07. 2017): 01.04.2017- 31.03.2021
4. Designing and Analysis of ON FARM Research Experiments Planned under AICRP on IFS. Funded by AICRP on IFS, ICAR-IIFSR. (AGEDIASRISOL201702000106)
   Cini Varghese, Sukanta Dash, Arpan Bhowmik: 01.04.2017- 31.03.2021
5. Planning, designing and analysis of data relating to experiments for AICRP on Long Term Fertilizer Experiments. Funded by AICRP on Long Term Fertilizer Experiments, ICAR-IISS. (AGEDIASRISOL201702100107)
   BN Mandal, Anindita Datta, Sunil Kumar Yadav: 01.04.2017-31.03.2021
6. Plant source based environmentally safe crop protection and production technologies: Development and capacity building under the Niche Area of Excellence (NAE) Programme of ICAR at IARI. (AGEDIASRICOP201900600152)
   ICAR-IARI: Anupama Singh, Rajesh Kumar, Supradip Saha
   ICAR-IASRI: Sukanta Dash, Anil Kumar: 27.03.2019-26.03.2022

7. Application of Next-Generation Breeding, Genotyping, and Digitalization Approaches for Improving the Genetic Gain in Indian Staple Crops. Funded by ICAR and Bill and Melinda Gates Foundation (BMGF). (AGEDIASRICOP201900200148)
   ICAR-IARI: AK Singh, Ranjith Kumar Ellur, S Gopala Krishnan, C Bharadwaj, Shailesh Tripathi, Rajbir Yadav, Harikrishna, Neelu Jain, M Ganapathi, Jyoti Kaul, RS Raje, G Rama Prashat, Durgesh Kumar
   ICAR-IIMR: T Nepolean, Madusudhana, B Aruna, Sanjana Reddy
   ICAR-IIPR: Abhishek Bohra, B Mondal
   ICAR-CPRI: Vinay Bhardwaj, Vinod
   ICAR-NRRI: JN Reddy, Anandan
   ICAR-IIRR: LV Subbarao, Abdul Fiaz
   ICAR-IIWBR: Satish Kumar, Ravish Chatrath
   ICAR-Project Coordinating Unit (Pearl millet): Vikas Khandelwal
   ICAR-Project Coordinating Unit (Chickpea): AK Srivastava
   ICAR-IASRI: Susheel Kumar Sarkar
   ICRISAT: Abhishek Rathore: 22.01.2019-21.01.2023

Completed
Institute Funded

8. Design involving multi-way genetic crosses for agricultural and animal breeding programmes. (AGENIASRISIL201700300089)
   Harun (till 11.09.2018), Anindita Datta (since 12.09.2018), Cini Varghese, Seema Jaggi: 09.03.2017-22.08.2020
9. Generalized row-column designs for cop and animal experiments. (AGENIASRISIL201700400090)
   Anindita Datta, Harun (till 11.09.2018), Seema Jaggi, Cini Varghese: 31.03.2017-09.07.2020

FORECASTING, MODELLING AND SIMULATION TECHNIQUES IN BIOLOGICAL AND ECONOMIC PHENOMENA

On-going
Institute Funded

10. Parameter estimation of time series models using Bayesian technique. (AGEDIASRISIL201702200108)
    Achal Lama, Bishal Gurung (till 19.07.2018), Santosha Rathod (till 13.06.2018): 01.11.2017- 31.03.2021
11. Modelling dynamics of institutional credit to agriculture in India. AGEDIASRISIL201900400150
    Harish Kumar H.V., Shivaswamy G. P., Anuja A R, Achal Lama: 02.02.2019-01.08.2021
12. Enhanced Classification And Regression Tree (CART) models for forecasting in agriculture. AGEDIASRISIL201900700153
    Ramasubramanian V., Mrinmoy Ray and Md. Wasi Alam: 31.03.2019-30.09.2021
13. Crop diversification: Pattern, determinants and its impact on nutritional

security in India. (AGEDIASRISIL201802800137)
Anuja AR, Rajesh T, Harish HV, Mrinmoy Ray: 05.09.2018-04.09.2021

14. Role of research and development in Indian agriculture: An economic analysis. (AGEDIASRISIL201802500134)
Rajesh T, Shivaswamy GP, Anuja AR, Ravindra Singh: 03.07.2018-02.07.2021
15. Prospects of irrigation in India: Trends, determinants and impact on agricultural productivity. (AGEDIASRISIL201802600135)
Shivaswamy GP, Rajesh T, Anuja AR, Harish Kumar HV and Achal Lama: 19.07.2018-18.07.2021
16. Tractorization in Semi Arid Tropic (SAT) India: Determinants and implications. (AGEDIASRISIL201701100097)
Ravindra Singh Shekhawat, Rajeev Ranjan Kumar (till 11.09.2018): 01.05.2017-20.01.2020

Outside Funded

17. Doubling Farmers' Income in India by 2021-22: Estimating Farm Income and Facilitating the Implementation of Strategic Framework. Funded by Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture, and Farmers Welfare, Govt. of India. (AGENIASRICOP201700600092)
ICAR-NIAP: Suresh Pal, Raka Saxena, Naveen P Singh, Usha R Ahuja
ICAR-IASRI: RK Paul: 31.03.2017-31.03.2022
18. Forecasting Agricultural output using Space Agrometeorology and Land based observations (FASAL). Funded by IMD, New Delhi. (AGENIASRICOP201600700076)
IMD: KK Singh, ICAR-IASRI: KN Singh, Bishal Gurung (till 19.07.2018) and Achal Lama (since 31.10.2018): 13.04.2016-31.03.2021
19. Modeling insect pests and diseases under climate change and development of digital tools for pest management National Innovations in Climate Resilient Agriculture (NICRA). Funded by ICAR. (AGEDIASRICOP201701500101)
ICAR-NCIPM: S Vennila, MN Bhat, Niranjan Singh
ICAR-CRIDA: M Prabhakar, MS Rao
ICAR-IASRI: RK Paul: 20.06.2017-31.03.2020
20. Studying dynamics of markets integration and price transmission of agricultural commodities under ICAR's Lal Bahadur Shastri Young Scientist Award 2016. (AGEDIASRISOL201801600125)
RK Paul: 02.04.2018- 31.03.2021
21. ICT based extension strategies for nutrition sensitive agriculture in the states of UP and Odisha. Funded by NASF. (AGEDIASRICOP201803600145)
ICAR-IARI: Premlata
ICAR-ATARI Zone-IV, Kanpur: Shantanu Dubey
Directorate of Extension Education OUAT, Bhubaneswar: PJ Mishra
ICAR-IASRI: KN Singh, Shashi Dahiya, Mrinmoy Ray: 01.11.2018-31.10.2021

22. Leveraging Institutional Innovations for Inclusive and Market led Agricultural Growth in Eastern India. Funded By NASF. (AGEDIASRICOP201901300159)
ICAR-IARI: Pramod Kumar
BHU, Varansi: PS Badal
ICAR-NRRI, Cuttack: Biswajit Mondal
CCS NIAM, Jaipur: Sathyendra Kumar
ICAR-IASRI: RK Paul: 01.12.2019-30.11.2022

Completed
Institute Funded

23. Modelling and forecasting of drought index using machine learning techniques. (AGEDIASRISIL201701200098)
Rajeev Ranjan Kumar (till 11.09.2018), KN Singh (since 12.09.2018), Ravindra Singh Shekhawat, Sanjeev Panwar: 22.05.2017-18.01.2020
24. Developments of count time-series models for predicting pest dynamics using weather variables. (AGEDIASRISIL201700900095)
Prawin Arya, Bishal Gurung (till 19.07.2018) and Md. Wasi Alam (since 20.07.2018): 19.04.2017-22.01.2020
25. Tractorization in Semi Arid Tropic (SAT) India: Determinants and implications. (AGEDIASRISIL201701100097)
Ravindra Singh Shekhawat, Rajeev Ranjan Kumar (till 11.09.2018): 01.05.2017-20.01.2020

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. Detection of outliers in presence of masking and imputation of data when auxiliary variable are available in sample surveys. (AGEDIASRISIL201901100157)
Raju Kumar, Ankur Biswas, Lal Mohan Bhar, Deepak Singh: 23.07.2019-22.12.2021

Outside Funded

27. Energy Audit Survey of AICRP on Energy in Agriculture & Agro-based Industries: Sampling design and analysis. Funded by ICAR-All India Coordinated Research Project on Energy in Agriculture & Agro-based Industries (ICAR-AICRP on EAAI). (AGEDIASRICOP201802000129)
ICAR-CIAE: KC Pandey
ICAR-IASRI: Hukum Chandra, Susheel Kumar (till 05.07.2018), Pradip Basak (since 11.07.2018), Ajit: 01.06.2018-31.05.2021
28. Integrated Sample Survey Solution for major Livestock Products. Funded by Animal Husbandry Statistics Division, Department of Animal Husbandry,

Dairying & Fisheries Ministry of Agriculture and Farmers Welfare, Govt. of India. (AGEDIASRISOL201900800154)

Prachi Misra Sahoo, Tauqueer Ahmad, Ankur Biswas, Pradip Basak, Anil Rai, SB Lal: 28.03.2019-30.09.2020

Completed

Institute Funded

29. Two step calibration for estimation of finite population total under two-stage sampling design. (AGEDIASRISIL201701600102)
    Pradip Basak, Kaustav Aditya, Hukum Chandra, Ajit: 29.07.2017-18.07.2020
30. Construction of composite index under complex surveys. (AGEDIASRISIL201801800127)
    Deepak Singh, Pradip Basak and Raju Kumar (since 05.12.2018): 26.04.2018-09.12.2020

Outside Funded

31. Study to estimate the sub-state level estimate of socio-economic indicators of Uttar Pradesh by using Small Area Estimation Techniques" in Collaboration with GIDS, Lucknow and funded by Directorate of Economics and Statistics Government of Uttar Pradesh, Lucknow. (AGEDIASRICOP201900900155)
    GIDS: K. Srinivasa Rao
    IASRI: Hukum Chandra, Pradip Basak, Kaustav Aditya : 01.06.2019-31.10.2020

New Initiated

Institute Funded

32. Estimation of Finite Population Proportion from Geo-Referenced Survey Data. (AGEDIASRISIL202000800167)
    Vandita Kumari, Pradip Basak (upto 30.11.2020), Hukum Chandra, Kaustav Aditya: 02.10.2020-01.10.2022

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

On-going

Institute Funded

33. Estimation of breeding value using generalized estimating equation and Bayesian approach. (AGEDIASRISIL201800100110)
    Himadri Shekhar Roy, LM Bhar, AK Paul: 07.02.2018-30.04.2021
34. A study on detection and interpretation of expression Quantitative Trait Loci (eQTL) mapping. (AGEDIASRISIL201800200111)
    Himadri Shekhar Roy, LM Bhar. RK Paul, AK Paul: 03.02.2018-31.03.2021
35. Development of web server for phenotype analysis for cattle breeding management. (AGEDIASRICIP201801100120)
    ICAR-CIRC: Umesh Singh, Susheel Kumar, AK Das, TV Raja, Rani Alex
    ICAR-IASRI: UB Angadi, MA Iquebal, Sarika, Dinesh Kumar: 12.03.2018-

31.03.2021

36. Study of robust estimation of heritability. (AGEDIASRISIL201801300122)
AK Paul, Himadri Sekhar Roy, LM Bhar, RK Paul: 22.03.2018-21.03.2021

37. Development of methodology for trait specific genes identification. (AGEDIASRISIL201900300149)
MS Farooqi, DC Mishra, KK Chaturvedi, Sudhir Srivastava (since 28.02.2020): 02.02.2019-30.04.2021

38. Machine Learning Approach for Binning of Metagenomics Data. (AGEDIASRISIL201901200158)
Anu Sharma, SB Lal, Sanjeev Kumar, DC Mishra: 24.7.2019-23.01.2022

Outside Funded

39. ICAR-Network project on functional genomics and genetic modification (Earlier: ICAR Network Project on Transgenics in Crops (NPTC)). Funded by ICAR-NRCPB-Sub-Scheme. (AGENIASRICOP201500400041)
ICAR-NRCPB: NK Singh (till 11.05.2015 and then from 10.01.2017), TR Sharma (from 12.05.2015-09-01-2017)
ICAR-IASRI: MA Iquebal, Sarika, Dinesh Kumar, Anil Rai: 27.01.2015-30.06.2021

40. Computational and analytical solutions for high-throughput biological data. Funded by CABin. (AGENIASRISOL201502400061)
Anil Rai, Dinesh Kumar, Monendra Grover, KK Chaturvedi, Sanjeev Kumar, DC Mishra: 04.09.2015-31.03.2021

41. Genomic and transcriptome sequencing of coriander (Coriandrum sativum) to reveal insight of its genomic architecture and breeding targets. (Collaboration with Junagadh Agricultural University, Junagadh). (AGEDIASRICOP201801200121)
JAU: Rukam Singh Tomar, MV Parakhia, Shradda B Bhatt
ICAR-IASRI: MA Iquebal, Sarika: 14.03.2018-31.03.2021

42. Statistical approaches for genome-wide association studies and genomic selection for multiple traits in structured plant and animal population. Funded by DST. (AGEDIASRISOL201801400123)
LM Bhar, Himadri Shekhar Roy (since 04.05.2018), PK Meher (since 04.05.2018): 16.03.2018-15.03.2021

43. Molecular Markers for Improving Reproduction of Cattle and Buffaloes. Funded by Bill & Melinda Gates Foundation. USA. (AGEDIASRICOP201803000139)
ICAR-NDRI: TK Datta, ICAR-CIRB: Varij Nayan
ICAR-IASRI: Dinesh Kumar, MA Iquebal, Sarika, UB Angadi, Anil Rai: 19.09.2018-30.09.2023

44. Genomics assisted crop improvement and management. Funded by NAHEP (AGEDIASRICOP201803200141)
ICAR-IARI: Viswanathan Chinnusamy
ICAR-IASRI: Sudeep, Seema Jaggi, Anindita Datta, Soumen Pal, Sanjeev Kumar: 26.09.2018-31.03.2021

45. Characterization, evaluation, genetic enhancement and generation of genomic resources for accelerated utilization and improvement of minor pulses. Funded by DBT. (AGEDIASRICOP201803500144)
ILS, Bhubneshwar: Ajay Kumar Parida
ICAR-NBPGR: Kuldeep Singh, DP Wankhede
ICAR-IASRI: Sanjeev Kumar, Anu Sharma
UAS, Bangalore: Niranjana Murthy
PAU, Ludhiana: Dharminder Bhatia
CSKHPKVV, Palampur: Rajan Katoch
VNMKV, Parbhani, Maharashtra: Deepak K Patil
ICAR-CAZRI, Jodhpur: Rajwant Kaur Kalia
World Vegetable Centre, South Asia, Hyderabad: RM Nair: 24.10.2018-23.10.2021
46. Improving the usability of buffalo spermatozoa by sperm surface remodelling and immune acceptance in female reproductive tract. Funded by NASF. (AGEDIASRICOP201802700136)
ICAR-NDRI: TK Datta, Rakesh Kumar, SM Deb, TK Mohanty, JK Kaushik
ICAR-IASRI: Sarika, Dinesh Kumar, MA Iquebal: 12.07.2018-11.07.2021
47. Molecular characterization, development of molecular markers and metabolite analysis of tree bean (*Parkia roxburghii*) landraces of North-East India. [BT/PR24912/NER/95/904/2017]. Funded by DBT. (AGEDIASRICOP201803100140)
ICAR Research Complex for NEH Region (Gangtok Sikkim Centre): Sudip Kumar Dutta, Ratankumar Akoijam, Vishambhar Dayal
UBKB, West Bengal: Somnath Mandal, Nandita Sahana
ICAR-IASRI: MA Iquebal, Sarika: 15.03.2019-14.03.2022

Completed

Institute Funded

48. Study of long memory and periodicities in climate variables in different Meteorological Subdivisions of India. (AGEDIASRISIL201701000096)
RK Paul, LM Bhar, AK Paul: 19.04.2017-06.11.2020
49. Discovery of novel genes and promoters responsible for salinity tolerance in Haloarcula spp. (AGEDIASRISIL201803400143)
Monendra Grover, DC Mishra, Rajeev Kaushik: 01.11.2018-17.07.2020

Outside Funded

50. Investigations on pathogenic microorganisms of shrimp aquaculture using metagenomic and other bioinformatic approaches. Funded by CABin Scheme. (AGEDIASRICOP201801000119)
ICAR-CIBA: Ashok Kumar Jangam, SV Alavandi, K Vinaya Kumar, R Mary Lini, Satheesha Avunje
ICAR-IASRI: Monendra Grover: 09.03.2018-31.03.2020
51. Deciphering genetic variation in the carbohydrate metabolism of farmed rohu families. Funded by CABin Scheme (AGEDIASRICOP201800500114)
ICAR-CIFA: JK Sundaray, S Nandi, PK Meher, L Sahoo, Kiran D, Khuntia Murmu, UK Udit, AR Rasal
ICAR-IASRI: Sarika, Dinesh Kumar, MA Iquebal, UB Angadi: 05.03.2018-

30.06.2020

52. Metagenomic profiling for assessing microbial biodiversity in river Ganga for ecosystem health monitoring. Funded by CABin. (AGEDIASRICOP2018022000131)

    ICAR-CIFR: BK Behera, BK Das, PK Parida, Dhruba Jyoti Sarkar, RK Raman

    ICAR-IASRI: Anil Rai, Anu Sharma (since 25.02.2020), PK Meher: 08.06.2018-30.06.2020

53. An integrative transciptomics and DNA methylomics approach to understand the dynamic features of biotic stress responses associated with mastitis in buffalos. Funded by CABin. (AGEDIASRICOP201900100147)
    ICAR-CIRB: Varij Nayan, SK Phulia, Anurag Bharadwaj
    ICAR-IASRI: MA Iquebal, Dinesh Kumar, Sarika: 16.01.2019-30.06.2020

54. Deciphering health biomarkers and thermo-tolerant traits by computational genomics approach in goats. Funded by CABin. (AGEDIASRICOP2018021000130)

    ICAR-CIRG: Rajveer Singh Pawaiya, K Gururaj, Mahesh Dige, PK Rout

    ICAR-IASRI: Anil Rai: 08.06.2018-31.03.2020

    Component 1: Host transcriptome analysis for identification of biomarkers and epitope mapping assisted diagnostics development for enterotoxaemia in goats.

    Component 2: Identification of heat stress/tolerance genes through transcriptomics approach in goats.

55. Structural and functional genomics of potato and its pest/pathogen using bioinformatics approaches. Funded by CABin. (AGEDIASRICOP201802400133)

    ICAR-CPRI: SK Chakrabarti, Shashi Rawat, Som Dutt, Jagesh Tiwari, Aarti Bairwa, Tanuja Buckseth

    ICAR-IASRI: Anil Rai, Sanjeev Kumar, DC Mishra, Neeraj Budhlakoti (till 11.09.2018): 08.06.2018-31.03.2020

56. Network project on computational biology and agricultural bioinformatics under two subprojects: Funded by CABin. (AGEDIASRICOP201802300132): 08.06.2018-31.03.2020

    Sub-project-1: Exploring the epigenetic control of heat stress response in wheat for characterizing the regulatory networks associated with thermo tolerance.

    ICAR-IARI: C Viswasnathan, RR Kumar, Suneha Goswami

    ICAR-IASRI: DC Mishra, Monendra Grover, Sanjeev Kumar, KK Chaturvedi

    Sub-Project-2: Studying drought-responsive genes in subtropical maize germplasm and their utility in development of tolerant maize hybrids.

    ICAR-IARI: Viswanathan Chinnusamy, Mallikarjuna, MG

    ICAR-IASRI: Anil Rai, PK Meher

57. Genomic data analysis to elucidate the regulatory network and candidate genes underlying cytoplasmic male sterility in pigeonpea. Funded by CABin Scheme (AGEDIASRICOP201800600115)

    ICAR-IIPR: A Bohra

    ICAR-IASRI: MA Iquebal, Dinesh Kumar, Sarika, UB Angadi: 05.03.2018-31.03.2020

58. Computational and experimental biology approaches for delineation of selected secondary metabolite pathways and antimicrobial peptides (AMPs) in major spices. Funded by CABin Scheme (AGEDIASRICOP201800400113)
ICAR-IISR: Johnson George K, TE Sheeja, R Praveena, P Umadevi, R Sivaranjani
ICAR-IASRI: UB Angadi, Dinesh Kumar, MA Iquebal, Sarika: 05.03.2018-30.06.2020

59. Computational approach for genomic resource improvement and precision phenotyping of less explored yield traits in Wheat. Funded by CABin Scheme (AGEDIASRICOP201800700116)
ICAR-IIWBR: Ratan Tiwari, Pradeep Sharma, Sonia Sheoran
ICAR-IASRI: Dinesh Kumar, MA Iquebal, Sarika, UB Angadi: 05.03.2018-30.06.2020

60. Transcriptome analysis to decipher mechanism related to distinctive morphological phenotypes in indigenous poultry. Funded by CABin. (AGEDIASRICOP201802900138)
ICAR-NBAGR, Karnal: Ramesh Kumar Vij
ICAR-IASRI: Anil Rai: 19.09.2018- 30.06.2020

61. Computational biology approach for deciphering stress induced transcriptomic and proteomic changes rice-microbial interaction system. Funded by CABin Scheme. (AGEDIASRICOP201800800117)
ICAR-NBAIM: DP Singh, Renu, Sunil Kumar, Pramod Sahu
ICAR-IASRI: Sanjeev Kumar, KK Chaturvedi, MS Farooqi: 06.03.2018-31.03.2020

62. Investigations on stipe rust-defence response, identification of defence genes/QTLs associated with rust resistance in Wheat. Funded by CABin Scheme. (AGEDIASRICOP201800900118)
ICAR-NBPGR: Sundeep Kumar, Amit K Singh
ICAR-IASRI: Monendra Grover, DC Mishra, Neeraj Budhlakoti (till 11.09.2018): 09.03.2018-31.03.2020

63. Rice-metasys: understanding rice gene network for blast resistance and drought tolerance through system biology approach. Funded by CABin Scheme. (AGEDIASRICOP201800300112)
ICAR-NRCPB: Amol Kumar U Solanke, SV Amitha Charu Rama Mithra
ICAR-IASRI: DC Mishra, KK Chaturvedi: 01.03.2018- 30.06.2020

64. Phenomics of moisture deficit stress tolerance and nitrogen use efficiency in Rice and Wheat– Phase II. Funded by National Agricultural Science Fund (NASF). (AGENIASRICOP201700700093)
ICAR-IARI: Viswanathan Chinnusamy
ICAR-IASRI: Anil Rai, Sudeep, Sanjeev Kumar
IIT, New Delhi: Brejesh Lall
ICAR-NRRI: Padmini Swain: 01.01.2017-30.06.2020

65. Potential gene mining from salt tolerant grasses for improvement of salt tolerance in crops. Funded by NASF (AGEDIASRICOP201701400100)
ICAR-CSSRI: Anita Mann, Ashwani Kumar, Arvind Kumar, BL Meena

ICAR-IASRI: Monendra Grover, DC Mishra: 01.06.2017-30.11.2020

New Initiated

Institute Funded

66. Development of statistical and computational approach for preprocessing and analysis high-throughput proteomics data with missing values. (AGEDIASRISIL202000200161)
    Sudhir Srivastava, DC Mishra, UB Angadi, KK Chaturvedi: 13.03.2020-12.09.2022
67. Modelling and forecasting for time-to-event analysis in Agriculture. (AGEDIASRISIL202000500164)
    Himadri Ghosh, AK Paul: 22.06.2020-21.03.2023
68. Explicating genomic insights of Indigenous equines breed population through "Computational Genomics" and "Artificial Intelligence" based approaches. (AGEDIASRICIP202000600165)
    ICAR-NRCE, Hissar: Anuradha Bhardwaj, Yash Pal
    ICAR-IASRI: Sarika, MA Iquebal, Dinesh Kumar: 17.08.2020-30.11.2022

Outside Funded

69. Mainstreaming rice landraces diversity in varietal development through genome wide association studies: A model for large-scale utilization of gene bank collections of rice. (DBT)
    (AGEDIASRICOP202000300162)
    ICAR-IARI, Director: Ashok Kumar
    ICAR-IASRI: Sarika, Dinesh Kumar, MA Iquebal: 01.05.2020-30.04.2025
70. Germplasm Characterization and Trait Discovery in Wheat using Genomics Approaches and its Integration for Improving Climate Resilience, Productivity and Nutritional Quality. (DBT)
    (AGEDIASRICOP202000400163)
    ICAR-NBPGR, Director: Kuldeep Singh
    ICAR-IASRI: Dinesh Kumar, UB Angadi,DC Mishra, Neeraj Budhlakoti, Sarika, MA Iquebal: 01.04.2020-31.03.2025
71. Minor Oilseeds of Indian Origin: Mainstreaming sesame germplasm for productivity enhancement and sustainability through genomics assisted core development and trait discovery. Funded by DBT.
    (AGEDIASRICOP202001200171)
    NBPGR: Kuldeep Singh, Rashmi Yadav & Ashok Kumar,
    ICAR-IASRI: UB Angadi, Dinesh Kumar, DC Mishra: 01.03.2020-28.02.2025
72. Network Project on Agricultural Bioinformatics and Computational Biology
    Activity 1-
    Identification of genes/ genomic regions associated with Fusarium head blight resistance in wheat
    Activity 2-
    Exploring the Molecular Regulatory Networks of Nutrient Use Efficiency and

Grain Quality in Wheat under Elevated Carbon Dioxide and Heat Stress for Developing Climate Resilient Wheat.

Activity 3-

Identification and Validation of Genes and Regulatory Elements for Combined Drought and Heat stress Tolerance through System Biology Approaches in Maize

Activity 4-

Study on expression QTL (e-QTL), epigenomics in relation to health and production traits in livestock

Activity 5-

Investigations on dietary alterations in shrimp for abiotic stresses using nutrigenomics approach

Activity 6-

Genomics-assisted identification of trait-specific markers for major biotic and abiotic stresses and development of core collections of black pepper

Activity 7-

Development of epsilon toxin based Novel vaccine against enterotoxaemia in goats: A bioinformatics assisted reverse vaccinology approach

Activity 8-

Comparative Genome Analysis of lndian Chicken Breeds

Activity 9-

Microbiome meta-transcriptomics assessment of Indian river basins for ecosystem health monitoring

Activity 10-

Genome Manipulation for the Management of Important Agricultural Insect Pests

Activity 11-

Meta-Analysis and computational approach for biomolecular interactions profiling of Sclerotinia sclerotiorum–Brassica pathosystem

Activity 12-

RiceMetaSys: Understanding of Rice Gene Network for Biotic and Abiotic Stress Management through System Biology Approach.

Activity 13-

Computational genomics guided accentuating genetic architecture of key traits in wheat and its validation.

Activity 14-

Investigation of kev transcripts and regulatory network associated with reproductive biology and medicinal value of striped murrel (Channa striata) using Omics approaches.

Activity 15-

Immunoreagent design, drug discovery and –omics approaches for buffalo production and reproduction

Activity 16-

Structural and functional genomics of potato and its pest / pathogen using bioinformatics approaches

Activity 17-
Understanding genomic factors responsible for growth performance in Clariasmagur
(AGEDIASRISOL202000900168)
Scheme Coordinator: Anil Rai
Co-Principal Investigator: Dinesh Kumar, Monendra Grover, UB Angadi, Sunil Kumar, KK Chaturvedi, SB Lal, Anu Sharma, Sarika, MA Iquebal, Samir Farooqi, Sanjeev Kumar, DC Mishra, Sudhir Srivastava, Neeraj Budhlakoti, Ratna Prabha, Sarika Sahu: 12.07.2020-31.03.2025

73. Genome wide association study in Indigenous poultry breeds/varieties. (AGEDIASRICOP202001000169)
ILRI: Hanotte Olivier, Dessie Tadelle
ICAR-Directorate of Poultry Research:TK Bhattacharya
ICAR-DPR: RN Chatterjee, SP Yadav, Chandan Paswan
ICAR-IASRI: Anil Rai, DC Mishra: 21.05.2020-31.03.2022
74. Identification and functional characterization of the key resistance/susceptible determinants for Sclerotinia stem rot disease in oilseed Brassica. (DST). (AGEDIASRICOP202001100170)
ICAR-NIPB: Navin Chandra Gupta, Mahesh Rao, Ramcharan Bhattacharya,
ICAR-IASRI: Dwijesh Chandra Mishra: 30.12.2020-31.12.2023

DEVELOPMENT OF INFORMATICS IN AGRICULTURAL RESEARCH

On-going
Institute Funded

75. 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): 01.04.2012–31.03.2021
76. National Information System on Agricultural Education Network in India. (NISAGENET-IV). (SIX1217)
RC Goyal (till 30.06.2013), Sudeep (since 01.07.2013), Alka Arora, Pal Singh, Shashi Dahiya (on study leave from 03.07.2014 to 02.07.2017 rejoins the project as associate from 25.10.2017), Soumen Pal (till 30.09.2012), Anshu Bharadwaj (since 01.10.2014):01.04.2012–31.03.2021
77. Implementation of ICAR-ERP, unified communication and web hosting solution. (AGENIASRISIL201500600043)
AK Choubey (till 21.01.2018), Sudeep (since 22.01.2018-PI & Associate till 21.01.2018), Alka Arora (on leave from 04.07.2016 to 22.03.2017 rejoins on 23.03.2017), N Srinivasa Rao (Transferred to NAARM from 24.09.2016), Mukesh Kumar, SN Islam (Deputed to ICAR HQ from 20.08.2016 for coordinating the implementation rejoins on 16.07.2018), Anshu Bharadwaj, Sangeeta Ahuja, Shashi Dahiya (from 05.08.2017): 10.04.2015-31.03.2021
78. Development and assessment of educational mobile apps for improving livestock health and production. (AGEDIASRICIP201701700103)
ICAR-IVRI: Rupasi Tiwari, Triveni Dutt, Mahesh Chander, Sanjay Kumar,

Amarpal, Putan Singh, JK Prasad, Bina Mishra, BHM Patel, Bablu Kumar, Mahendran
ICAR-IASRI: Sudeep, Mukesh Kumar, Soumen Pal: 28.06.2017-31.03.2021

79. Training Management Information System for ICAR (TMIS). (AGEDIASRISIL201801900128)
Shashi Dahiya, Sudeep, Sangeeta Ahuja: 01.05.2018-31.03.2021

Outside Funded

80. Management and impact assessment of farmer FIRST project. Funded by ICAR farmer FIRST programme under KVK scheme (ATARI-I) (AGENIASRICOP201700200088)
ICAR-NIAP: Shiv Kumar, Rajni Jain, Vinayak R Nikam, Kinsly IT, Abhimanyu Jhajhria
ICAR-NAARM: P Venkatesan, Bharat S Sontakki, N Sivaramane
ICAR-IASRI: Mukesh Kumar, Anshu Bharadwaj, Soumen Pal
ICAR-DKMA: Aruna T Kumar, Mitali Ghosh Rai: 14.02.2017-31.03.2020
81. Knowledge management system for agriculture extension services in Indian NARES. Funded by ICAR Extramural Research Projects-Agricultural Extension Division. (AGENIASRICOL201600500074)
ICAR-IASRI: Alka Arora, AK Choubey (till 20.01.2018), NS Rao (till 24.09.2016), SN Islam, Soumen Pal, Sudeep, Ajit (since 29.08.2018), RK Paul (since 29.08.2018)
ICAR: P Adiguru: 04.03.2016-31.03.2021
82. Investments in Indian Council of Agricultural Research leadership on Agricultural Higher Education under the National Agricultural Higher Education Project (NAHEP Comp-2 Project). (AGEDIASRISOL201900500151)
ICAR-IASRI: Sudeep, Alka Arora, Anshu Bharadwaj, Mukesh Kumar, Shashi Dahiya, Pal Singh, SN Islam, Soumen Pal, Ajit, Ramasubramanian V, Mrinmoy Ray, Achal Lama, Arpan Bhowmik (since 13.12.2019)
ICAR-NAARM: SK Soam, D Thammi Raju, N Srinivasa Rao, Alok Kumar, VV Sumanthkumar, Sanjiv Kumar, Surya Rathore
ICAR-NIAP: Rajni Jain: 28.02.2019-31.03.2021
83. Artificial intelligence based mobile app for identification and advisory of maize diseases and insect pests. Funded by NASF ICAR Hq. (AGEDIASRISOL201901000156)
ICAR-IASRI: Sudeep, Alka Arora, Mukesh Kumar, SN Islam
ICAR-IIMR Ludhiana: KS Hooda
IIT, Delhi: Brejesh Lall: 01.01.2019-31.12.2021

Completed
Institute Funded

84. Development of direct benefit transfer portal for DARE schemes. (AGEDIASRISIL201801500124)
Soumen Pal, Sudeep, Alka Arora: 26.03.2018-29.07.2020

New Initiated

85. Cereal Systems Initiative for South Asia (CSISA) Integration with KVK Portal. Funded by International Maize and Wheat Improvement Center (CIMMYT) through Extension Division, ICAR. (AGEDIASRICOP202000700166)
Soumen Pal, Alka Arora, Sudeep, SN Islam, Ajit, RK Paul :01.04.2020-31.03.2021

Consultancy Projects

1. Technical guidance on the sampling strategy and developing sampling methodology for Lao Agriculture census. Tauqueer Ahmad 27.02.2021 - 27.12.2021

National Fellow Scheme

2. Robust and efficient small area estimation methods for agricultural and socio-economic surveys and their application in indo-gangetic plain.
Hukum Chandra: 25.11.2014-24.11.2024