Statistical tools/techniques:

Developed sampling methodologies for the different commodity groups and corresponding three **guidelines for estimation of post-harvest losses of fruits and vegetables, livestock (meat and milk) and fish products** which are accepted by FAO of the United Nations (FAO), Rome, Italy for adoption and were field tested in four countries namely Mexico, Zambia, Nepal and Thailand.

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.

Developed, a novel machine-learning algorithm called Multi-Branch Ferns (**MBFerns**) to build multi-branch ferns (multi-branch decision tree) and to generate key features from training dataset employing Naïve Bayesian probabilistic model as classifier.

Method of constructing classes of Trend Free Partially Balanced Incomplete Block (**TR-PBIB**) designs based on different association scheme have been developed. For providing readymade solutions to the end users, SAS macros for the generation of such designs have also been developed.

Developed an online platform, "**Web-SpikeSegNet"** based on a deep-learning framework for spike detection and counting from the wheat plant's visual images and digital image analysis. As spike detection and counting in wheat phenotyping are closely related to the yield, "Web-SpikeSegNet" is a significant step forward in the field of wheat crop yield phenotyping.

Established estimation technique of ARIMAX and ARIMAX-GARCH models using Bayesian framework and developed a product "**BayesARIMAX**" which is freely accessible will provide researchers a vast opportunity to implement this model working in the domain of time series forecasting.

Developed a new hybrid model (**NBPFCROS**) based on parametric and non-parametric statistic for the identification of DE-genes (differentially expressed).

Proposed an innovative statistical approach and tool, namely **GSQSeq** (Gene Set analysis with QTL sequences), to analyse gene sets with genetically rich trait data, such as QTL.

Developed twelve R-packages:

1. **eemdTDNN**: EEMD and Its Variant Based Time Delay Neural Network Model
2. **EEMDelm**: Ensemble Empirical Mode Decomposition and Its Variant Based ELM Model
3. **EMDANNhybrid**: Ensemble Machine Learning Hybrid Model
4. **ECTTDNN**: Co-integration Based Time-delay Neural Network Model
5. **MARSANNhybrid**: Multivariate Adaptive Regression Spline (MARS)
6. **MARSSVRhybrid**: MARS SVR Hybrid
7. **EMDSVRhybrid**: Hybrid Machine Learning Model
8. **grapesAgri1** 1.0.0: as Collection of Shiny Apps for simple Agricultural Research Data Analysis.
9. **EEMDSVR**: Ensemble Empirical Mode Decomposition and its Variant Based Support Vector Regression Model.
10. **GreyModel**: Fitting and Forecasting of Grey Model.
11. **tsfngm**: Time Series Forecasting using Nonlinear Growth Models.
12. **LARGB**: Leaf Area Determination from Visual Image. (https://cran.r-project.org/package=LARGB).

Statistics have been developed for detection of outliers in presence of masking in survey weighted regression. A calibrated estimator has been developed for outlier imputation when auxiliary variables are available in sample surveys. The R code is written for evaluation of developed methodologies.

Contribution of ICAR-IASRI Mentioned in FAO-Guidelines on Measurement of Harvest and Post-harvest Losses of Livestock (Meat and Milk).

Sampling methodology for 2019/20 Lao Agriculture Census developed by ICAR-IASRI has been recommended and adopted by FAO of the United Nations for conducting Agriculture Census and generating estimates for parameters of interests for Lao, PDR.

Informatics tools/techniques:

Virtual Classroom is the new paradigm of digital learning in agricultural education system, established at 18 Agricultural Universities across India. "**Virtual Classroom** & **Agri-Diksha Web Education Channel**" was inaugurated on 16th April 2021.

Developed **ICAR-AU-Grievance Redressal & Monitoring System** for Agricultural Universities.

"**KISAN-SARATHI**"- System of Agri-information Resources Auto-transmission and Technology Hub Interface, is an Information Communication and Technology (ICT) based interface solution launched on 16th July, 2021 to support the emerging need of multi-ways and multi-lingual communication among various agricultural stakeholders.

Developed and released the video film of "**Agricultural University-Clean and Green Campus Awards**" by Honourable Prime Minister in VC conference on 28th Sept. 2021. A booklet entitled "Strengthening the Agriculture Education through Digital Interventions" along with **Agriculture Experts Information System** (AEIS) and Management System for **StudentREADY** were released.

Developed a portal "**Plant Trees**" which provides a unified platform for KVKs/Institutes/AUs to record the number of trees planted, upload images of the events and record any other key information.

Developed a "**BRICS Agricultural Research Platform**" which allows officials of all BRICS countries to register and collaborate on various themes as per the objectives of BRICS 2020-2021 Agenda.

Mobile App for **Integrated Sample Survey Solutions for Major Livestock Products**: An android-based application-**eLISS** data collection app has been developed and is available on google play store to capture data from the field, which was collected manually using paper-based schedules by the enumerators. All the eight schedules of Integrated Sample Survey (ISS) scheme have been captured by the app.

KISAAN 2.0 (Krishi Integrated Solution For Agri Apps Navigation) App: Developed KISAAN 2.0 (Krishi Integrated Solution for Agri Apps Navigation) App envisaged to help e-agriculture and to drive smart phone based agriculture in India. This app integrates more than 300 Agricultural related apps developed by ICAR Institutes in an aggregator android mobile app. KISAN 2.0 has been developed based on data being provided through Webservices from ICAR Mobile App Gallery (KRISHI Portal). The developing Institutes would provide data on KRISHI Portal and it would automatically be ported to KISAN 2.0. Therefore, any new application developed will be added to KISAN 2.0 and discontinued application would get removed from this mobile app. It has been developed with an aim to make farming convenient for Indian farmer. KISAAN 2.0 app provides a single interface in multiple Indian languages for Indian farmers to access agricultural knowledge about crops, horticulture, livestock, fisheries, natural resource management, agricultural engineering, agricultural education and agricultural extension. This app will revolutionize the way how an Indian farmer avails information on advance agricultural technologies, seeds, varieties and livestock.

Salient Features:

- Available in 12 regional languages.
- Subject wise interactive Dashboard.
- Includes 300+ Agri-Apps

Bioinformatics tools/techniques/databases/servers:

Developed 15 biological databases/web-servers in collaboration with various ICAR Institutes

1. ***BSCM2TDb:*** a database on water buffalo that contain the data generated from differential DNA methylation extracted from MeDIP-seq data
2. ***BtChiLCVDb*****:** online relational database of Silverleaf whitefly (transcriptome
3. ***SCMVTDb:*** transcriptome-based Mosaic Virus Database in small or green cardamom
4. ***ParkRoxTDB*****:** Tree Bean (Parkia roxburghii) Transcriptome Database
5. ***SIReDAM*****:** Systematic Information Resources for Dairy Animal Management
6. ***Levidb*****:** Genomics of Virus in Legume Crops**:** Viral diagnostics of legume crop
7. ***Millet SSR:*** **C**omputational tool stores catalogue of Millet microsatellites
8. **BPDRTDb**: Black Pepper Drought Transcriptome Database
9. **LrSATDb**:transcriptome database of seasonality associated genes of Carp fish, Rohu
10. **WBMSTDb**: Water Buffalo (Bubalus bubalis) Mastitis Database
11. **PlantSSRDb**: SSRs information accompanied with the primer pair information for 439 plants species.
12. **TpGBNVDb:** Thrips palmi transcriptome database
13. **CsExSLDb:** Cucumis sativus Extended Shelf-Life Database
14. **miRbiom:** Machine Learning based Webserver to Profile miRNAs
15. **RBPSpot:** Machine learning based webserver for RBP binding sites discovery

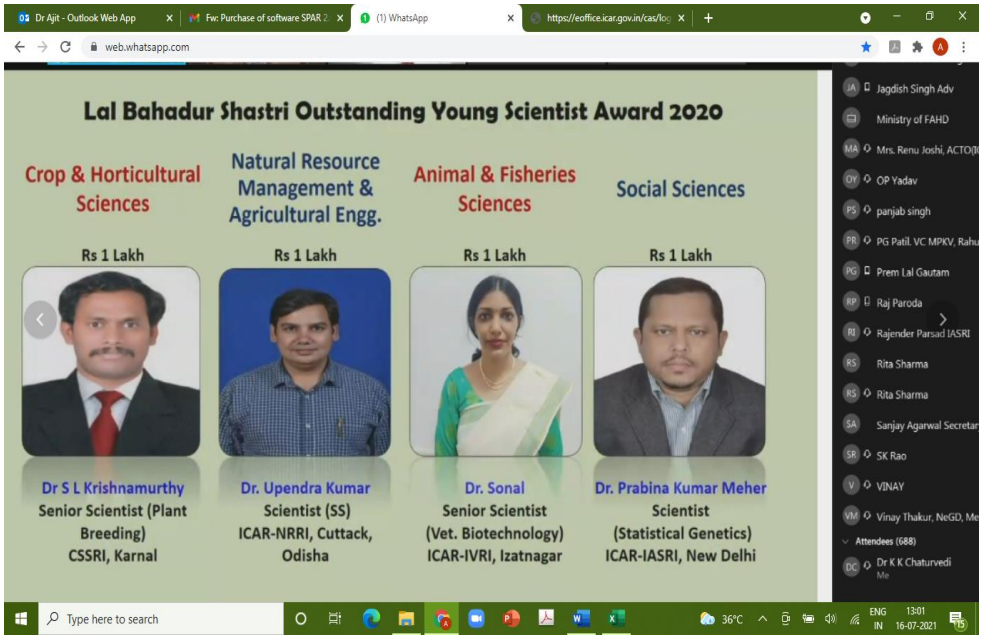
Trainings conducted:

Conducted seventeen (17) on-line training programs (ranging from 2 to 21 days duration) which were attended by 1000 + participants

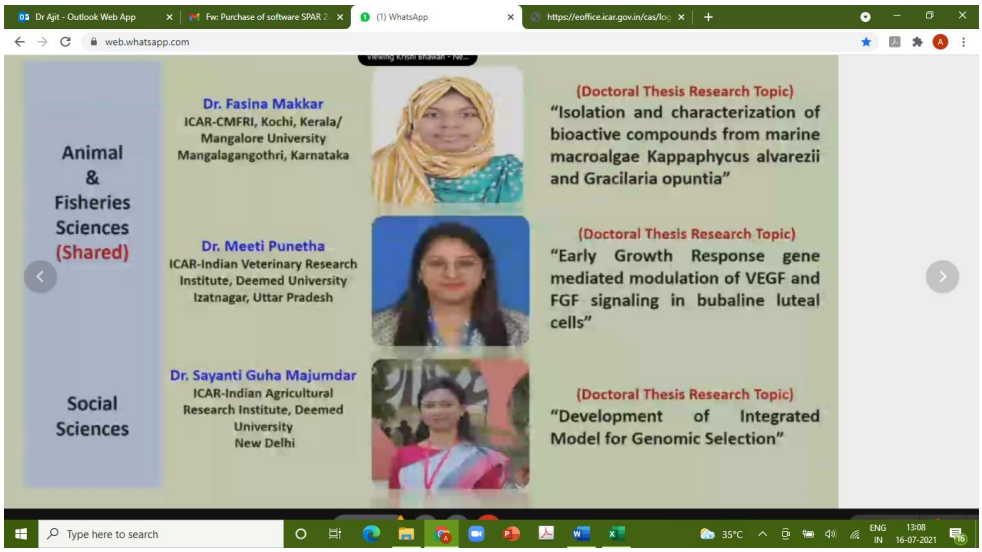
1. "**Software and Tools for Bioinformatics**" during January 11-13, 2021 with 20 participants.
2. "**All India Training of Master Trainers on Web Portal and Android App for ISS Scheme**" during 17-18 February 2021 with 356 participants
3. "**Statistics for Social Science Scholars**" for 30 M.F.Sc./ Ph.D. Fisheries Economics/ Extension students of ICAR-CIFE, Mumbai during 23rd February to 22nd March, 2021
4. "**Recent Advances of Statistical Analysis in Agriculture**" during 04-12 March, 2021with participants
5. "**Advanced Designs for Product and Process Development Oriented Experiments**" during 16-17 March, 2021.
6. "**Design of experiments and Next Generation Sequencing Data Analysis**" during March 16-17, 2021 for ICAR-NIBSM, Raipur.
7. "**सांख्यिकीय आनुवंशिकी और कृषि में इसके अनुप्रयोग**" विषय पर एक हिन्दी कार्यशाला का आयोजन । (18-20 March, 2021)
8. "**Next Generation Sequence Data Analysis**" for Contractual staff during 22-27 March, 2021.
9. Hindi workshop on "**Statistical Modelling and Forecasting in Agriculture**" during 24-26 June, 2021. with 28 participants.
10. "**e-Governance Applications in ICAR for Technical Staff**" during 6-10 September 2021 with 56 participants.
11. "**Transcriptomic Data Analysis under CRP on Genomics**" during September 28-30, 2021with 118 Participants.
12. Hindi Workshop on "परीक्षण अभिकल्पना के अनुप्रयोग' during September 28-30, 2021 with 18 Participants.
13. **"Statistical Techniques for Data Analysis in Agriculture"** during 4-13 October 2021 with 125 participants.
14. **"Experiments Data Analysis"** for Technical Personnel during 20-29 October 2021 with 16 participants
15. **"Molecular Structure Simulation and Modelling"** during 27-30 October 2021 with 72 participants.
16. "**Proteomics Data Analysis**" during November 24-26, 2021 with 26 participants.
17. **"SNP Mining, GWAS and Genomic Selection"** during December 16-21, 2021.

Awards Received:

Dr. Prabina Meher conferred with ICAR-Lal Bahadur Shastri Outstanding Young Scientist Award-2020 on ICAR Foundation Day on 16th July, 2021



Dr. Sayanti Guha Majumdar, IASRI Ph.D. Bioinformatics received award for best doctoral thesis in social sciences on thesis entitled "Development of Integrated Model for Genomics Selection"



Dr. D.C. Mishra received "Young Professionals Award" in the International Conference on Research Initiatives for Agriculture Biotechnology and Allied Sciences (ICRIABAS) held during 24-25, April, 2021 and organized by IIMT University, Meerut, UP.

Sh. Prakash Kumar received Young Scientist Award on the occasion of International web Conference on Global Research Initiatives for Sustainable Agriculture and Allied Science (GRISAAS, 2021) on

13th December 2021 organized by Society for Scientific Development in Agriculture & Technology(SSDAT).

Details of students passed out and admitted during 2020-21

Sr. No.	Course	Students passed out	Students Admitted
1	Ph.D. (Agricultural Statistics)	**4**	**9**
2	M.Sc. (Agricultural Statistics)	**6**	**6**
3	Ph.D. (Computer Application)	**0**	**7**
4	M.Sc. (Computer Application)	**7**	**7**
5	Ph.D. (Bioinformatics)	**2**	**8**
6	M.Sc. (Bioinformatics)	**3**	**5**
	Total	**22**	**42**