



- Research Achievements
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- Consultancy/Advisory Services
- Copyrights/MOUs
- Panorama of Activities
- Participation in Conferences
- Awards and Recognitions
- Personnel
- Publications
- Human Resource Development
- Projects Initiated/Completed

From the Director's desk ...

This Newsletter brings to you the key research achievements, awards and recognitions received, training programmes conducted, workshops and conferences organized/ attended, advisory services provided and significant publications of ICAR-IASRI during the period under report.

The Institute developed an android mobile application, called AI-DISC (Artificial Intelligence Based Disease Identification for Crops) that can automatically identify 50 plant diseases of 19 crops based on image in natural background. AgrIntel, a framework consisting of multiple Artificial Intelligence-based pipelines has been developed to process nationwide farmers' helpline data and obtain spatio-temporal insights on plant protection. A deep learning approach, "Yield-SpikeSegNet," has been developed for the yield estimation in the wheat plant using visual images. In Design of Experiments, obtained two series of partially balanced t-designs which are useful in Integrated Farming System research involving both crop and livestock components and also introduced nearly balanced treatment incomplete block designs. A prediction server PIDBPred for DNA-binding Protein (DBP) prediction in plant has been developed based on a comprehensive computational model for plant specific DBPs identification. To identify novel interactions between Acr and Cas proteins, proposed machine learning-based predictive model using an ensemble strategy with more than 95% accuracy. Academic Management System was launched by Dr. G.P. Samanta, Chief Statistician of India at Sher-e-Kashmir University of Agricultural Sciences and Technology-Kashmir, Srinagar on November 15, 2022 and for Odisha University of Agriculture and Technology, Bhubaneswar, it was launched on December 07, 2022.

Tree Saplings of Chandan (*Santalum Album*) were planted by Ms. Alka Nangia Arora, Financial Advisor, ICAR; DDG (Agricultural Education), DDG (Natural Resource Management), Director, ICAR-National Institute of Agricultural Economics and Policy Research), New Delhi and Director, ICAR-IASRI, New Delhi. Fit India Run 3.0, Kisan Diwas, Vigilance Awareness Week, Constitution Day and Sadbhawana Diwas were also organized. A total of 50 Research Papers, 2 Book Chapters and 06 R Packages were published. Initiated 08 new research projects and 04 research projects were completed. We congratulate our Alumni Dr. Seema Jaggi for receiving Sankhyki Bhusan Award from Indian Society of Agricultural Statistics. Through 04 training programmes including one under Centre of Advanced Faculty Training trained 160 personnel and 64 participated in two Hindi Workshops. The Institute also sponsored two training programmes for Scheduled Caste farmers at ICAR-Central Agro-forestry Research Institute, Jhansi.

A Letter of Agreement (LoA) was signed with Food and Agriculture Organization of the United Nations-India for reviewing the Food Loss Index estimates for India. Memorandum of Understanding (MOUs) were also signed with ASRB for development, implementation and functioning of online Application and Score card Information System and CSIR-National Botanical Research Institute, Lucknow for genomic data analysis.

The scientists of the Institute brought recognitions by way of serving as Expert Members in various high level committees, presenting research work in prestigious conferences/workshops.

I earnestly hope that the contents of this Newsletter would be useful and informative to you all. Any constructive comments for better presentation of this newsletter are most welcome.




(Rajender Parsad)

RESEARCH ACHIEVEMENTS

AgrIntel: Spatio-Temporal Profiling of Nationwide Plant-Protection Problems using Kisan Call Centre Helpline Data

Sustainable development of the national food system must ensure the introduction of adequate food security interventions and policies. However, several high-end technological developments remain unexplored, which can be used to gain explicit information regarding agricultural problems. In this direction, AgrIntel, a framework consisting of multiple AI-based pipelines has been proposed to process nationwide farmers' helpline data and obtain spatiotemporal insights regarding food-production problems on an extensive scale. AgrIntel overcomes several limitations of the existing methods used for similar objectives, including limited scalability, low frequency and high cost. The call-logs dataset used is obtained from the nationwide network of farmers' helpline centers, managed by the Ministry of Agriculture & Farmers' Welfare, Government of India and available on Open Government Data Platform through APIs. The Spatio-temporal profile of one of India's highest food grain-affecting diseases, i.e. *blast in rice crop* has demonstrated the utility of the AgrIntel pipelines. First, the proposed framework extracts and clusters the precise geographical locations of farmers calling for help corresponding to the target agricultural problem. Next, the temporal modeling of the problem helps extract the critical dates corresponding to the crop disease/pest spread. Furthermore, by incorporating the historical agroclimatological data, a new medium has been introduced to extract the favourable weather conditions corresponding to the targeted disease/pest outbreak. In addition, the potential of Deep Learning models (based on Artificial Neural Network, Convolutional Neural Network, Gated Recurrent Unit and Long short-term memory unit) has been explored to efficiently predict the futuristic demand for assistance regarding target problems (RMSE of ≈ 1.5 and MAE of ≈ 0.9 query calls). The obtained results expose unrevealed insights regarding food production problems, significantly boosting the food security policy-designing procedure.

Yield-SpikeSegNet: An extension of SpikeSegNet Deep-Learning Approach for the Yield Estimation in the Wheat using Visual Images

High-throughput plant phenotyping integrated with computer vision is an emerging topic in the domain of non-destructive and non-invasive plant breeding. Analysis of the emerging grain spikes and the grain weight or yield estimation in the wheat plant for a huge number of genotypes in a non-destructive way has achieved significant research attention. A deep learning approach, "Yield-SpikeSegNet," has been developed for the yield estimation in the wheat plant using visual images. This approach consists of two consecutive modules: "Spike detection module" and "Yield estimation module." The spike detection module is implemented using a deep encoder-decoder network for spike segmentation and output of this module is spike area and spike count. In yield estimation module, machine learning models have been developed using artificial neural network and support vector regression for the yield estimation in the wheat plant. The model's precision, accuracy and robustness are found satisfactory in spike segmentation as 0.9982, 0.9987, and 0.9992, respectively. The spike segmentation and yield estimation performance reflect that the Yield-SpikeSegNet approach is a significant step forward in the domain of high-throughput and non-destructive wheat phenotyping.

Nearly Balanced Treatment Incomplete Block Designs

In several experimental situations, the experimenter may be interested to compare a set of new treatments called test treatments with one established treatment called control. Often there may be a nuisance factor that needs to be taken care of during experimentation. Balanced Treatment Incomplete Block (BTIB) designs are quite popular for comparing test versus a single control treatment. The class of BTIB designs has been extended by introducing nearly BTIB designs. Nearly BTIB designs can act as a useful alternative to BTIB designs when the latter is not available for a given parametric combination. An algorithm is proposed to construct nearly BTIB designs and a list of such designs is also provided in a practically useful parametric range.

Partially Balanced t-designs

Small and marginal farmers in India prefer an Integrated Farming System (IFS) approach i.e. a mixture of crop and livestock that enables them to maintain a stable income throughout the year. Identifying the best location-specific t-component crop-livestock combination to generate maximum profit is the major concern. Here, two series

of partially balanced t-designs with some interesting characterization properties have been obtained by using the triangular association scheme. These designs have high application potential in crop and animal experimentation, especially in IFS research involving both crop and livestock components.

P/DBPred: A Computational Tool for DNA-Binding Protein Prediction in Plants

DNA-binding proteins (DBPs) play crucial roles in numerous cellular processes in plant including gene expression, maintaining genome stability, and response to environmental stresses. Accurate identification of DBPs in agriculture have wide-ranging utilities, including identifying regulatory proteins, guiding breeding and genetic engineering efforts, enhancing disease resistance and stress tolerance, optimizing nutrient management and aiding in functional annotation of crop genomes. Majority of the computational techniques suggested for identifying DBPs are mainly applicable to human and mice datasets. Even though some models have been tested on Arabidopsis, they produce poor accuracy when applied to other plant species. Despite substantial improvements in the prediction of DBPs, the development of plant-based models is mostly disregarded.

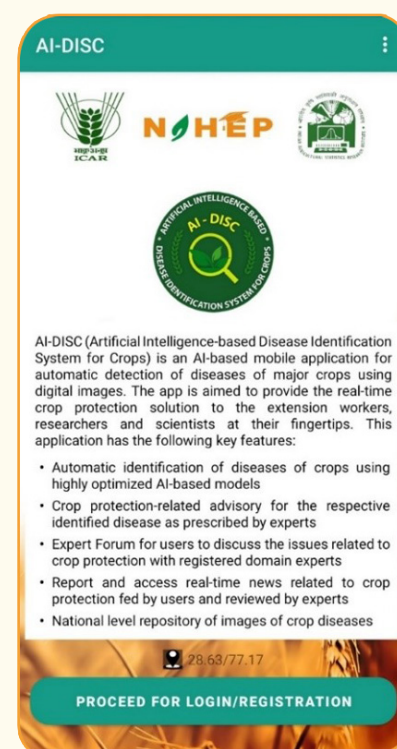
To bridge the gap, ICAR-IASRI has developed a machine learning based computational tool scalled “P/DBPred” to identify DBPs in plants. To develop the generalised plant specific models, DBP dataset covered 36 different plant species including cereals, pulses, oilseed, vegetables, fruits and commercial crops. The developed approach achieved a repetitive five fold cross validation accuracy of 94.0% area under the ROC curve and 93.5% area under the precision recall. Additionally, P/DBPred achieved high accuracy and out performed several cutting-edge existing tools for plant specific DBP recognition using an independent dataset. Proteome-wide DBP identification, followed by in silico validation, confirmed the reliability and generalized ability of the P/DBPred for any plant species. To easy its access to plant biologist P/DBPred is also implemented in the form of an online prediction tool which is freely accessible at <https://iasri-sg.icar.gov.in/pldbpred/>. The source code is also provided at https://iasri-sg.icar.gov.in/pldbpred/source_code.php for prediction using a large-size dataset.

The proposed approach is expected to supplement the existing tools and methodologies for recognizing DBPs in plants. The P/DBPred can be applicable to cereals, pulses, oilseed, vegetables, fruits and commercial crops and will contribute to the development of improved crop varieties and sustainable agricultural practices, thereby addressing global food security and agricultural sustainability challenges.

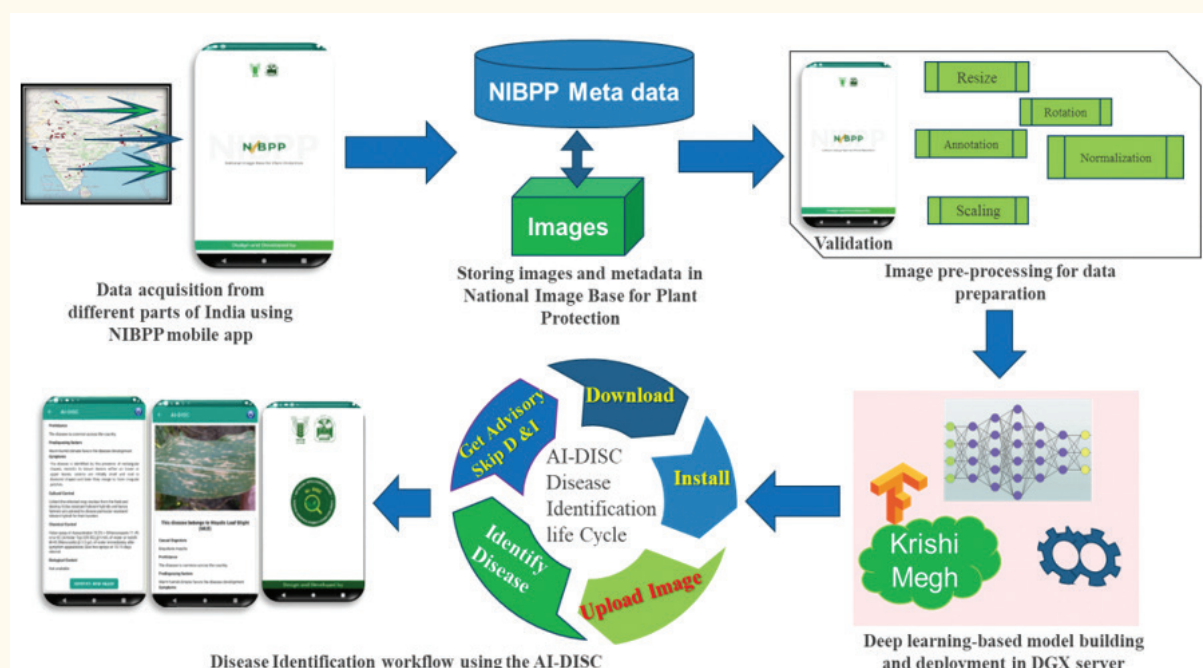
AI-DISC (Artificial Intelligence Based Disease Identification for Crops) Mobile App

Developed an Artificial Intelligence (AI) based android mobile application, called AI-DISC (Artificial Intelligence Based Disease Identification for Crops) available at https://play.google.com/store/apps/details?id=com.ai.ai_disc) that can automatically identify plant diseases with visible symptoms. This is one of the premier AI applications of its kind in ICAR. Sophisticated Deep learning techniques have been used for detection of the diseases with a simple, user-friendly interface. User has to install the mobile app, capture the disease image in natural background and click to identify and get the remedy advisory of the diseases. Presently, the application is capable of identifying 50 diseases in 19 major crops. It also provides remedies along with the identified disease. Following is the list crops and diseases covered in AI-DISC.

- **Rice:** Bacterial Leaf Blight, Brown Spot, False Smut, Blast, Narrow Brown Leaf Spot, Tungro and Sheath Rot, Sheath Blight
- **Wheat:** Brown Rust, Black Rust, Yellow Rust
- **Maize:** Maydis Leaf Blight, Tucicum Leaf Blight, Common Rust, Brown Stripe, Downy Mildew, Curvularia Leaf Spot, Sorghum Downy Mildew, Banded Leaf and Sheath Blight
- **Greengram:** Powdery Mildew, Yellow Mosaic
- **Cluster Bean:** Bacterial Blight, Powdery Mildew
- **Mothbean:** Crinkle Virus, Yellow Vein Mosaic
- **Chickpea:** Collar Rot, Wilt and Root Rot
- **Mustard:** Downy Mildew, Powdery Mildew, White Rust
- **Cotton:** Bacterial Blight, Cotton Leaf Curl Virus, Wilt



- **Cucurbits:** Alternaria Leaf Spot
- **Tomato:** Early Blight, Late Blight, Leaf Curl and Target Leaf Spot
- **Coriander:** Powdery Mildew, Stem Gall
- **Brinjal:** Early Blight, Phomopsis Leaf Blight, Little Leaf and Phomopsis Leaf Blight
- **Chilli:** Anthracnose, Leaf Curl Virus
- **Apple:** Alternaria Leaf Blotch, Apple Mosaic Virus, Apple Scab, Marssonina Leaf Blotch
- **Peach:** Leaf Curl, Shot Hole
- **Kinnow:** Citrus canker, Fruit Rot, Greening
- **Assam Lemon:** Citrus Greening, Citrus Tristeza Virus
- **Mandarin:** Dieback, Sooty Mold



AcrCasPPI: Prediction of Protein–Protein Interactions between Anti-CRISPR and CRISPR-Cas using Machine Learning Technique

CRISPR-Cas system, responsible for bacterial adaptive immune response, has evolved as the game-changer in the field of genome editing and has revolutionized both animal and plant research owing to its efficiency and feasibility. CRISPR-associated (Cas) protein, an integral component of the CRISPR-Cas toolkit, cut the target genetic material for making the desirable edits. However, unchecked nuclease activity of Cas protein may lead to unforeseen off-target effects. Anti-CRISPR (Acr), small proteins usually found in phages and other mobile genetic elements, are the natural inhibitors of the Cas proteins that help phages to escape the immune system of the host. Acr proteins regulate the activity of the Cas nuclease by interacting with its different domains which results in the blockage of CRISPR activity. Thus, it is essential to understand the interactions between these two rival proteins in order to switch off the cutting machinery when needed. Experimental methods to identify protein–protein interactions, are often costly, time-consuming, and labor-intensive. Computational strategies, such as data-driven predictive models, can complement experimental studies by providing fast, efficient, reliable and cheaper alternatives to predict protein interactions.

The Institute has introduced the first machine learning-based predictive model to identify novel interactions between Acr and Cas proteins using an ensemble strategy. The proposed ensemble-RF model achieved a 97% of five fold cross validation accuracy indicating its high predictive power. The developed predictor outperformed the existing tools in all the performance evaluation criteria using an independent dataset. Due to its encouraging results, to extend the support for diverse levels of end-users, a web application named AcrCasPPI was developed which is available at <http://login1.cabgrid.res.in:5020/>. Alternatively, a python package named `acrcasppi-ml`, is also available at <https://pypi.org/project/acrcasppi-ml/>. The developed model can contribute to automate the process of discovering the natural inhibitors of Cas protein for controlling the off-target cleavage and improving the efficiency of CRISPR-Cas technology.

Developed R-packages: 06

- **pRepDesigns:** Partially replicated (p-Rep) designs for early generation breeding trials have wide application potential as only a proportion of the test lines are replicated at each environment. Available at <https://cran.r-project.org/package=pRepDesigns>
- **PolycrossDesigns:** This package contains a function named PD() which generates nine types of polycross designs suitable for various experimental situations. Available at <https://CRAN.R-project.org/package=PolycrossDesigns>
- **OptiSembleForecasting:** In this package, ensembled based optimization technique using 13 models have been implemented. An PCA based error index has been proposed to select a group of best models using MCS algorithms. After selecting the models, the forecasts from these models have been ensembled using optimization techniques. Available at <https://CRAN.R-project.org/package=OptiSembleForecasting>
- **GETdesigns:** Generalized Extended Triangular Designs. Available at <https://CRAN.R-project.org/package=GETdesigns>
- **ResPBIBD:** Resolvable Partially Balanced Incomplete Block Designs (PBIBDs). Available at <https://CRAN.R-project.org/package=ResPBIBD>
- **ARIMAANN:** Time Series Forecasting using ARIMA-ANN Hybrid Model. Available at <https://CRAN.R-project.org/package=ARIMAANN>

PANORAMA OF ACTIVITIES

Tree Plantation Programme

- Dr. R.C. Agrawal, DDG (Agricultural Education), ICAR and Mrs. Alka Nangia Arora, Financial Advisor (DARE) visited the Institute and planted Saplings of Chandan (*Santalum Album*) tree on October 21, 2022. A discussion about the activities of the Institute and Walk through in Campus were also held. Dignitaries also visited ICAR-DATA Centre and ASHOKA.



- Dr. S.K. Chaudhari, DDG (Natural Resource Management), ICAR visited Instiute on November 01, 2022 and Planted Tree sapling Chandan (*Santalum album*). He also interacted with Director and other staff members of the Institute. Dr. Rajender Parsad, Director, ICAR-IASRI also planted a sapling Chandan (*Santalum album*) on this day.



Dr. Pratap Singh Birthal, Director, ICAR-National Institute of Agricultural Economics and Policy Research planted a sapling of Chandan (*Santalum album*) on November 10, 2022 in presence of Director and staff of ICAR-IASRI, New Delhi.



Fit India Run 3.0

- Organised Fit India Freedom Run 3.0 on October 21, 2022. Staff and students of the Institute participated in Fit India Run through the campus.

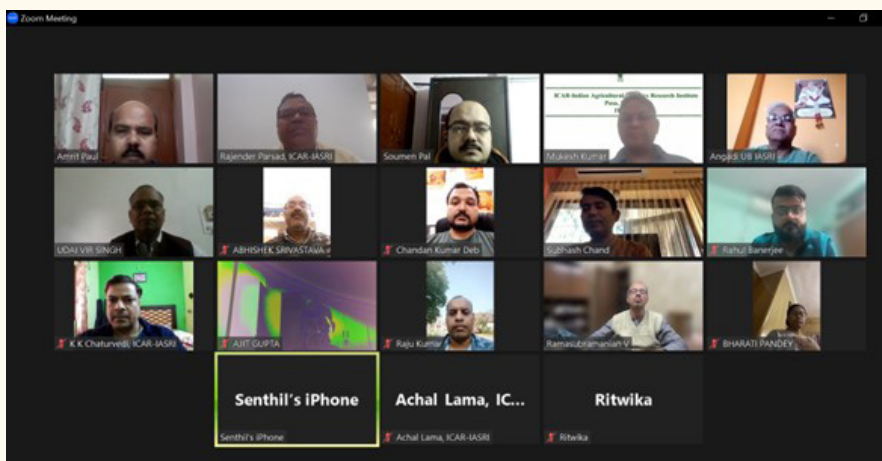


Celebrations of Vigilance Awareness Week

- Institute organized Vigilance Awareness week during Oct 31-November 06, 2022 on the theme **Corruption- free India for a Developed Nation**. Director, Scientists, Technical and Administrative personnel took Integrity Pledge on October 31, 2022. Dr. Pankaj Kumar, Director (Animal Science), ICAR, New Delhi delivered a seminar on CCS (Conduct) Rules on November 02, 2022. Posters were also displayed in each building of the Institute during the week.

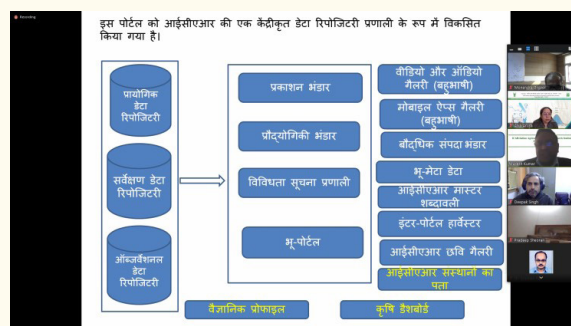
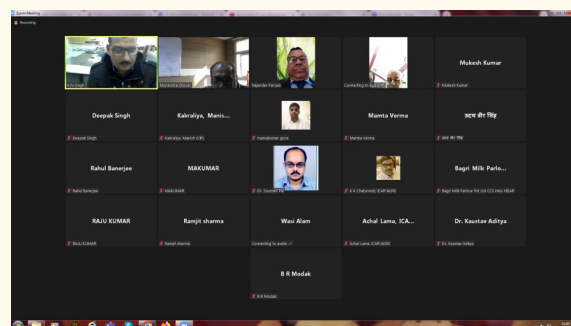
Celebrations of Constitution Day 2022 and Pledge of Preamble

- Institute celebrated Constitution Day on November 26, 2022. The staff and students read the Preamble along with Director, ICAR-IASRI, New Delhi.



Celebrated Kisan Diwas (National Farmers' Day) 2022

Kisan Diwas was celebrated online on December 23, 2022. Dr. Rajender Parsad, Director, ICAR-IASRI inaugurated the celebrations. He explained the importance of Celebrating Kisan Diwas on the Birthday of Late Choudhary Charan Singh, Former Prime Minister of India. He also welcomed the farmers (i) Sh. Pradeep Sheoran from Haryana; (ii) Sh. Anil Pharsawal from Uttar Pradesh; (iii) Sh. Manish from Punjab and (iv) Sh. Ranjit Sharma from Bihar. The invited farmers also delivered talks on the Kisan Diwas on various topics like Dairy and dairy products, Organic agriculture, Climate smart agriculture, Seed production. Dr. Mukesh Kumar demonstrated ICAR Video Gallery, ICAR Mobile App Gallery and ICAR Technology Repository. Dr. Alka Arora made a presentation on Krishi Vigyan Knowledge Network Portal (KVK Portal) and explained on how this portal is useful to interlink digitally farmers, scientists and domain experts of agriculture. She also explained on how to use the mobile app of KVK portal, what and how information can be gathered from this portal. She also shared information about KISAAN 2.0 (Krishi Integrated Solution for Agri Apps Navigation) which integrates 300+ Agricultural related apps developed by ICAR Institutes, SAUs, KVKs and other Govt. Departments. It is an aggregator mobile app that 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 etc. Dr. Soumen Pal presented the following mobile apps developed in collaboration with ICAR-Indian Veterinary Research Institute (IVRI), Izatnagar: (i) IVRI Animal Reproduction App; (ii) IVRI-Pig Farming App; (iii) IVRI-Vaccination Guide App; (iv) IVRI- Disease Control App; (v) IVRI-Artificial Insemination app and (vi) IVRI-Dairy Manager app. Dr. K.K. Chaturvedi demonstrated Kisan Sarathi - System of Agri-information Resources



Auto-transmission and Technology Hub Interface which is an Information Communication and Technology (ICT) based interface solution with an ultimate goal of supporting agriculture at local niche with national perspective. It is intended to provide a seamless, multimedia, multi-ways connectivity to the farmers with the latest agricultural technologies, knowledge base and the pool of large number the subject matter experts. The farmers while expressing their views lauded the efforts of ICAR scientists and also stressed the need for further improvement in the farmer-research community interaction.



Swachhata Campaign

Swachhata Pakhwada: organized during December 16-31, 2022. Swachhata pledge was taken on December 16, 2022. As part of Swachhata Pakhwada following activities were performed by ICAR-IASRI Staff/Students and Contractuals: stock taking on digitization of office records/e-office implementation was undertaken; review of progress on weeding out old records, disposing of old and obsolete furniture, junk materials and white washing/painting was conducted. Cleanliness and Sanitation drives were carried out in residential colony near IASRI campus. The residents of the colony were counselled on cleaning of their premises and surroundings. Staff members were requested to perform cleaning in their respective residential colonies and nearby market places. Video shows on the following topics were organized: (i) Promoting Clean and Green Technologies; (ii) Recycling water including treating sewage water to make it drinkable and treating kitchen waste water for reuse; (iii) Documentary film on Swachh Bharat Mission Grammeen; (iv) Biodegradable and non-biodegradable waste. A debate was also organized on the topic *Swachhata Mission has shown good progress since its inception and is on right track*. Swachhata committee addressed farm labours at ATIC Centre, ICAR-IARI, New Delhi. Chief Guest Dr. Prabhat Kumar, Horticulture Commissioner, Ministry of Agriculture and Farmers’ Welfare, Government of India stressed on relationship between traditional knowledge and Swachhata as Chief Guest during the Valedictory function.



Others

- **Special Swachhata Activities:** Institute also organised Swachhata activities during October and November 2022 in and around IASRI campus.



- Communal Harmony Day (Sadbhavana Diwas) on November 19, 2022.

WORKSHOPS/WEBINARS/MEETINGS/ETC. ORGANIZED

Workshops/Webinars

- Workshop on **Sampling Design and Analysis** under the project AICRP on EAAI project organized on October 20, 2022 regarding and determination of sample size and collection of data. A total of 49 participants attended the same. (Kaustav Aditya)
- Workshop on **Breeding Informatics in Plant Breeding** organized jointly by ICAR-IARI, EIB CIMMYT and ICAR-IASRI under the aegis of ICAR-BMGF Collaborative Project **Application of Next-Generation Breeding, Genotyping, and Digitalization Approaches for Improving the Genetic Gain in Indian Staple Crops** at ICAR-IASRI, New Delhi during December 28-30, 2022. (Susheel Kumar Sarkar and Anil Kumar)

Meetings

- Technical Review Committee Meeting of Horticulture Domain-Network Project on Agricultural Bioinformatics and Computational Biology under the Chairmanship of DDG (Horticulture), ICAR on December 27, 2022. (Anil Rai)
- Interaction meet of Officer Incharge Data Management under the project ICAR Research Data Repository for Knowledge Management was organized on November 10, 2022. The meet was Chaired by DDG (NRM) and Chairman, Steering Committee and Co-Chaired by DDG (Education). 93 participants including Directors and Officer Incharge of ICAR Institutes attended the meet. (Rajender Parsad)
- ICT Steering Committee Meeting was organized under the Chairmanship of Secretary DARE and DG ICAR on December 05, 2022. (Anil Rai)

Seminars Delivered

A total of 12 seminars on different areas of Agricultural Statistics, Computer Application and Bioinformatics which include presentations on new project proposals, salient findings of the completed research projects and Training

undertaken at International level by the Scientists, Course/ Thesis/ ORW Seminars of students of M.Sc. and Ph.D. disciplines of Agricultural Statistics, Computer Application and Bioinformatics. The category-wise break-up is given below:

Category	Type of Seminar	Number
Scientist	Project Completion	2
	New Project Proposal	
	Foreign Visit	1
	General	
Student	Course	4
	ORW	
	Thesis	5
Total		12

Internship Programme

Two M.Sc. Bioinformatics students Mr. Abhishek Kumar Sahu and Ms. Soumya Ranja Sahoo of Odisha University of Agriculture and Technology, Bhubneswar worked as Interns/trainee for their dissertation work during October 20-December 19, 2022 under the guidance of Dr. Prabina Kumar Meher. The title of the study for Mr. Abhishek Kumar Sahu was **A Computational Study on DNA Binding Protein Prediction Based on Machine Learning Algorithm** and for Ms. Soumya Ranja Sahoo was **A Computational Study on Sub-cellular Localization of mRNA**.

PUBLICATIONS

Research Papers

- Ahmed B, Haque Md Ashraful, Iquebal MA, Jaiswal S, Angadi UB, Kumar D and Rai A (2022). DeepAProt: Deep learning based abiotic stress protein sequence classification and identification tool in cereals. *Frontiers in Plant Sciences Section Plant Abiotic Stress*, **13**. <https://doi.org/10.3389/fpls.2022.1008756>
- Anjum A, Jaggi S, Lall S, Varghese E, Rai A, Bhowmik Aand Mishra DC (2022). Segmentation of genomic data through multivariate statistical approaches: comparative analysis. *Indian Journal of Agricultural Sciences*, **92(7)**, 92-96.
- Ashok K, Bhargava CN, Babu KP, Rohan W, Manamohan M, Rai A, Sanjay KP, Parvathy MS, Kennedy JS and Asokan R (2022). First report on CRISPR/Cas9 mediated editing of the eye colour gene, Tryptophan 2, 3-dioxygenase in egg plant shoot and fruit borer *Leucinodesorbonalis* Guen'ee (Lepidoptera: Crambidae). *Journal of Asia-Pacific Entomology*, **26(1)**. <https://doi.org/10.1016/j.aspen.2022.102031>
- Baisvar VS, Kushwaha B, Kumar R, Kumar MS, Singh M, Rai A, Sarkar UK (2022). BAC-FISH based physical map of endangered catfish *clariasmagur* for chromosome cataloguing and gene isolation through positional cloning. *International Journal of Molecular Science*, **23(24)**, 15958. <https://doi.org/10.3390/ijms232415958>
- Balakumaran M, Chidambaranathan P, Kumar TJP, Sirohi A, Jain KP, Jain PK, Gaikwad K, Iyyappan Y, Rao AR, Sahu S, Dahuja A (2022). Deciphering the mechanism of anhydrobiosis in the entomopathogenic nematode *Heterorhabditisindica* through comparative transcriptomics. *PLoS ONE*, **17(10)**, e0275342. <https://doi.org/10.1371/journal.pone.0275342>
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9. Bunkar K, Prakash S, Ramasubramanian V, Krishnan M and Kumar NR (2022). Economic and social transformation through fish farming: A CSR initiative in Bharatpur district, Rajasthan. *Indian Journal of Fisheries*, **69(4)**, 109-114. <https://doi.org/10.21077/ijf.2022.69.4.117003-14>
10. Devi M, Mishra P, Pal S, Sinha K and Chetna (2022). Modelling and forecasting wheat production in Punjab state of India using hierarchical time series models. *Indian Journal of Ecology*, **49(6)**, 2370-2376.
11. Devi S, Sharma PK, Behera TK, Jaiswal, S, Boopalakrishnan G, Kumari K, Mandal NK, Iquebal MA, Gopala KS, BhartiGhosal C, Munshi, AD and Dey SS (2022). Identification of a major QTL, *Parth6.1* associated with parthenocarpic fruit development in slicing cucumber genotype, Pusa Parthenocarpic Cucumber-6. *Frontiers in Plant Science*, **13**. <https://doi.org/10.3389/fpls.2022.1064556>
12. Godara S, Toshniwal D, Bana RS, Singh D, Bedi J, Parsad Rajender, Dabas JPS, Jhajhria A, Godara S, Kumar R and Marwaha S (2022). AgrIntel: Spatio-temporal profiling of nationwide plant-protection problems using helpline data. *Engineering Applications of Artificial Intelligence*, **117(A)**, 105555. <https://doi.org/10.1016/j.engappai.2022.105555>
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 50. Yeligar S, Kumar S, Venkatesh P, Kingsly I, Nain MS, Paul RK and Madhurima U (2023). Prevailing status of agricultural trade between India and European Union. *Indian Journal of Extension Education*, **59(1)**, 13-18.

Book Chapters

- Godara S, Begam S, Kaur R, Bedi J, Bana RS, Singh D, Marwaha S and Parsad Rajender (2022). Prospects of Artificial Intelligence in Agriculture. In: *Futuristic Trends in Agriculture Engineering & Food Sciences*, IIP Proceedings, Volume 2, Book 9, Part 1, Chapter 4. ISBN:978-93-95632-65-2
- Mishra DC, Guha Majumdar S, Budhlakoti N, Kumar A and Chaturvedi KK (2022). OMICS Tools and Techniques for Study of Defense Mechanism in Plants. In: *Thermotolerance in Crop Plants*. Eds. Kumar RR, Praveen S and Rai GK. Springer, Singapore, pp 237-250. https://doi.org/10.1007/978-981-19-3800-9_11

Policy Brief

- Saxena R, Paul RK, Balaji SJ, and Kumar R (2022). *India's Agricultural Exports during the Covid-19 Pandemic. Policy Brief, 50.*

Pamphlet

- Sharma Anu, Farooqi Mohammad Samir and Das Ritwika (2022). Metagenomics Data Analysis, online Training Programme under CRP Genomics Project, E-Brochure (English and Hindi), ICAR-Indian Agricultural Statistics Research Institute, New Delhi.

PAPERS PRESENTED/LECTURES DELIVERED

Paper presented/Invited talk delivered in Conferences

- International conference of **The Indian Ecological Society on Sustainable Agricultural Innovations for Resilient Agri-Foods System** organized at SKUAST-Jammu during October 13-15, 2022
 - Banerjee R*, Pal S and Ahmad T. Prediction approach in repeated measurement Survey.
- 73rd Annual Conference of Indian Society of Agricultural Statistics on **Statistics and Machine Learning for Big Data Analytics** organized by Division of Agricultural Statistics, FOH, SKUAST-K, Srinagar during November 14-16, 2022
 - Anindita Datta*, Seema Jaggi, Cini Varghese, Eldho Varghese, Mohd Harun and Arpan Bhowmik. Row-column designs with multiple units per cell balanced for spatial effects (Dr GR Seth Young Scientist Award Session).
 - Modh. Harun*, Cini Varghese, Seema Jaggi, Eldho Varghese and Anindita Datta. Augmented partial four-way crosses.
 - Bijoy Chanda*, Arpan Bhowmik, Cini Varghese, Seema Jaggi, Eldho Varghese and Anindita Datta. Equivalent-estimation two levels split-plot designs.
 - Rahul Banerjee*, Seema Jaggi, Eldho Varghese, Arpan Bhowmik, Cini Varghese, Anindita Datta and Shwetank Lall. Construction of saturated D-optimal designs for mixture experiments with a non normal response using an algorithmic search.
 - Ankita Verma*, Seema Jaggi, Eldho Varghese, Arpan Bhowmik, Cini Varghese and Anindita Datta. Construction of third order rotatable designs using t design of unequal set sizes.
 - Vinay Kumar LN*, Cini Varghese, Seema Jaggi and Mohd. Harun. Variance components estimation and BLUP in breeding programmes under p-Rep block designs.
 - Nehatai W. Agashe*, Cini Varghese, BN Mandal and Mohd. Harun. Designs for breeding trials using doubly nested partially balanced incomplete block designs.
 - Sayantani Karmakar*, Cini Varghese, Seema Jaggi and Mohd. Harun. On t-packing designs.
 - Sukanta Dash. Designs for consecutive cropping sequence Experiments.
 - Hemant Kumar* and Susheel K Sarkar. Evaluation of artificial intelligence in plant breeding management tools.
 - RK Paul*. Decomposition based machine learning techniques for forecasting agricultural prices.
 - Prakash Kumar*, Upendra Kumar Pradhan and Ravi Shankar. RbpRnaDB: A database for RNA-binding proteins and their combinatorial interactions with miRNA to explain the miRNA biogenesis model.
 - Bishal Gurung* and KN Singh. An improved beta regression model for forewarning *Helicoverpa armigera* infestation.
 - Rajeev Ranjan Kumar* and KN Singh. Performance evaluation of deep learning approaches for meteorological drought forecasting.
 - Soumen Pal*, Alka Arora, Sudeep, Ajit, SN Islam and Ranjit Kumar Paul. Analytics dashboard for landscape diagnostic survey data under cereal systems initiative for South Asia.
 - Chandan Kumar Deb*, Pabitra Mitra and Madhurima Das. Machine learning based mapping and its acreage calculation for rice crop using Sentinel 2 in Cooch Behar district of West Bengal, India.
 - Madhu*, Chandan Kumar Deb, Ashraful Haque, Sudeep Marwaha, SN Islam, Achal Lama and Mrinmy Ray. Deep learning-based classification model for bovine disease detection.
 - Alka Arora* and Mohit Kumar. Machine learning based approach for measuring senescence in wheat crop.

(Invited Talk)

- Shashi Dahiya*, Sudeep Marwaha, P Ramasundaram and Anshu Bharadwaj. Online initiative for ranking of green and clean agricultural university campus. (Invited Talk)
 - Sarika Jaiswal*, Bharti Aneja, Jaisri Jagannadham, Bharati Pandey, Rajender Singh, Chhokar, Subhash Chander Gill, Om Parkash Ahlawat, Anuj Kumar, UB Angadi, Anil Rai, Ratan Tiwari and Dinesh Kumar. Study on microbial diversity under varied agricultural field conditions of wheat crop.
 - MA Iqbal. Whole Genome-based identification of non-coding RNAs in Black pepper (*Piper nigrum* L).
 - Ritwika Das*. Identification of major biogeochemical cycle regulating genes in river Ganga and Yamuna through metagenomic approaches.
 - Mohammad Samir Farooqi*, KK Chaturvedi, DC Mishra, Sudhir Srivastava, SB Lal, Anu Sharma and Neeraj Budhlakoti. Prediction of biosynthetic gene clusters and drug discovery using metagenomics.
 - Sudhir Srivastava*, Dwijesh Chandra Mishra, UB Angadi, KK Chaturvedi and Anil Rai. Hybrid approach for imputing missing values in proteomics expression data.
 - Anu Sharma. Some contributions to machine learning for binning of metagenomics data.
 - DC Mishra*, Sudhir Srivastava, Neeraj Budhlakoti, KK Chaturvedi, SB Lal and Anil Rai. Next generation sequencing data analysis: big data perspective.
 - Neeraj Budhlakoti. Integrated approach for genomic prediction to handle diverse genetic architecture.
 - Anshu Bharadwaj*, Sudeep, Alka Arora, Mukesh Kumar, Shashi Dahiya, SN Islam, Soumen Pal, Rajender Parsad, Anuradha Agrawal, R.C. Agrawal. Virtual Classroom and Agri-DIKSHA: Embracing the future of Digital Learning in Agriculture Higher Education. (Invited Talk)
 - Tauqueer Ahmad*, Prachi Mishra Sahoo and Ankur Biswas. Integrated sampling methodology for crop yield estimation using remote sensing, GIS, Geo-statistics and field surveys for Crop Insurance. (Invited Talk)
 - H Chandra, K Aditya*, S Gupta, S Guha and B Verma. Food and nutrition in Indo Gangetic Plain Region-a disaggregate level analysis.
 - Deepak Singh*, Pradip Basak, Raju Kumar and Tauqueer Ahmad. Development of survey weighted composite indices under complex surveys.
 - Ankur Biswas*. Estimation of finite population proportion from geo-referenced survey data.
 - Raju Kumar*, Deepak Singh and Tauqueer Ahmad. Survey weighted propensity score method for impact assessment.
 - Pankaj Das*, Achal Lama and Girish Kumar Jha. Variational mode decomposition based machine learning models optimized with genetic algorithm for price forecasting.
 - Rahul Banerjee*, Seema Jaggi, Eldho Varghese, Arpan Bhowmik, Cini Varghese, Anindita Datta and S Lall. Construction of saturated D-optimal designs for mixture experiments with a non normal response using an algorithmic search.
 - Hukum Chandra, Kaustav Aditya*, Swati Gupta, Saurav Guha and Bhanu Verma. Food and nutrition in indo gangetic plain region-a disaggregate level analysis.
 - Ramasubramanian V*, Mrinmoy Ray and Md. Wasi Alam. Development of classification tree enhanced by genetic algorithm for forecasting in agricultural ergonomics.
 - Mukesh Kumar*, Soumen Pal and Sudeep. Mobile applications for dissemination of knowledge in livestock farming.
 - SB Lal*, KK Chaturvedi, Anu Sharma and Md. Samir Farooqi. Open-source big data databases.
 - Vinayaka*, Rajender Parsad, B.N. Mandal and Sukanta Dash. Nested Partially Balanced Treatment Incomplete Block Designs. (Student Session: Contributed Paper)
 - Sudeep*, Alka Arora, Anshu Bharadwaj, Shashi Dahiya, SN Islam, Chandan Kumar Deb, Ashraful Haque and Sanchita Naha. Modernizing agriculture education through IT interventions - Steps undertaken.
- IEEE International Conference on **Computing, Communication and Intelligent Systems** (ICCCIS-2022) organized by Greater Noida, India, Sharda University during November 04-05, 2022
 - Madhu. Content-based image retrieval: feature extraction techniques and similarity metrics.
 - International Conference on **Intelligent Vision and Computing** (ICIVC 2022) organized at NIT Agartala during November 26-27, 2022
 - Akshay Dheeraj. Deep learning model for automated image based plant disease classification.

- International Conference on **Global Research Initiatives for Sustainable Agriculture & Allied Sciences** (GRISAAS-2022) organized at BAU Ranchi during November 21-23, 2022
 - Deepak Singh*, Pradeep Basak, Raju Kumar and Taqueer Ahmad. Construction of survey weighted food consumption index.
 - JS Brar, Pankaj Das* and T Adhikary. Optimization of energy requirement and greenhouse gas emissions analysis for pear producers of North-West India using data envelopment analysis (DEA) approach.
 - Bharti*, PK Mahajan and S Bansal. Marketing analysis of apple farming in high hills of Himachal Pradesh.
- National Conference on **Innovations in Animal Genetics and Breeding for sustainable productivity of livestock and poultry** organized at DPR, Hyderabad during December 02-03, 2022
 - DC Mishra. Innovations in genomics data in livestock and poultry.
- Eighth International Conference on **Statistics for Twenty-first Century-2022** (ICSTC-2022) organized by International Statistics Fraternity (ISF), School of Physical and Mathematical Sciences and Department of Statistics, University of Kerala, Trivandrum during December 16-19, 2022
 - Bishal Gurung. ESTAR nonlinear models for modelling sunspot numbers and global temperatures and development of out-of-sample forecasts.
 - Mrinmoy Ray. FRBW-STNN: Fuzzy rule based weighted spatio-temporal neural network model with application to rainfall forecasting.
 - Achal Lama. Modelling volatility movement between Indian domestic and International edible oils price indices using Bayesian multivariate GARCH models.
 - Rajeev Ranjan Kumar. Wavelet Multiple Kernel Extreme Learning Machine (W-MK-ELM) model for drought forecasting.
 - Prakash Kumar. A novel non-parametric stability measures for selection of stable genotypes to resolve the consequences of climate dynamics.
 - Anindita Datta. Web generation of generalized row-column designs.
 - Kaustav Aditya. Multivariate calibration estimation using nonlinear constraints under two stage sampling design.
 - Ankur Biswas. Estimation under geographically weighted logistic regression model from survey data.
 - Pankaj Das. Estimation of crop yield using random forest spatial interpolation technique.
 - Vinayaka* and Rajender Parsad. Nested partially balanced incomplete block designs.
- International Indian Statistical Association conference (IISA-2022) organized at Indian Institute of Science, Bengaluru during December 26-30, 2022
 - Sukanta Dash. Designing factorial experiments for cropping sequence experiments.
 - Mohd Harun. Generalized extended triangular association scheme and designs.
 - Ashutosh Dalal. Asymmetric rotatable designs for fitting response surface model incorporating neighbour effects.
 - RK Paul. Wavelets and machine learning techniques for forecasting time series.
- International Conference on **Knowledge Discoveries in Statistical Innovations and Recent Advances in Optimization (ICON-KSRAO)** organized by Department of Statistics and Population Research Center, Andhra University, Visakhapatnam, Andhra Pradesh during 29-30 December 2022
 - RK Paul. Machine learning techniques for forecasting agricultural commodity prices.
 - Soumen Pal. Analytics dashboard for landscape diagnostic survey data under rice and wheat cropping system.
 - Md. Yeasin. Optimization based ensemble techniques for modelling potato price in markets of Odisha, India.
 - Vinayaka*, Rajender Parsad, BN Mandal, Sukanta Dash and Vinaykumar LN Partially balanced bipartite block designs.

(*denotes who has presented the paper)

Lecture Delivered (Outside institute)

- Training programme on Practical Approaches to Bioinformatics and Omics Technologies organized under the aegis of NAHEP - Centre for Advanced Agricultural Science and Technology (CAAST-ACLH) project at ICAR-Indian Veterinary Research Institute, Izatnagar, U.P during October 10-14, 2022
 - **Introduction to genome assembly** on 13.10.2022. (D.C. Mishra)
 - **Introduction to R and Rstudio for bioinformatics** on 13.10.2022. (Sudhir Srivastava)
 - **Index development** on 13.10.2022. (Ramasubramanian V.)
- One lecture on **In silico lead molecule designing for enzymatic and proteinous receptor** was delivered on 18.10.2022 at Maitreyi College University of Delhi. (Sarika Sahu)
- Centre of Advanced Faculty Training (CAFT) programme on Diversity, Genomics and Development of Robust Diagnostics for Fusarium spp. associated with major economically important diseases in India at the Division of Plant Pathology, IARI, New Delhi during October 11-20, 2022
 - **Application of bioinformatics for the understanding of Fusarium genomics** on 19.10.2022. (M.A. Iquebal)
 - **RNaseq data analysis** on 19.10.2022. (Sarika)
- Cyber Jagrookta Awareness program at ICAR-NCIPM New Delhi on November 11, 2022.
 - **Cyber Security and Financial Frauds.** (KK Chaturvedi)
- One lecture on **Cyber Security** was delivered on 01.12.2022 in the Workshop for Technical Officers of ICAR Institute including ICAR Deemed Universities at ICAR-NDRI Karnal during November 30 to December 2, 2022 on the occasion of centenary celebration of the institute. (Sudeep Marwah)
- Workshop for Technical Personnel working in ICAR Institutes organized by ICAR-NDRI, Karnal during November 30- December 02, 2022.
 - **E-Governance applications in ICAR – An overview** on 30.11.2022. (Sudeep)
 - **TMIS for ICAR and E-Learning Portal** on 31.11.2022. (Shashi Dahiya)
- Two days Faculty Development Programme (offline mode) on Molecular Tools & Techniques in Life-Sciences organized at the Department of Botany, Chaudhary Charan Singh University, Meerut, Uttar Pradesh during December 02-03, 2022
 - **R programming for bioinformatics** on 03.12.2022. (Sudhir Srivastava)
- NAHEP Sponsored Training Programme on Advanced Research Methods and Essential Skills for Social Sciences at Division of Agricultural Economics, ICAR-IARI, New Delhi during December 12-22, 2022.
 - **Application of cointegration in social science research** on 14.12.2022. (Rajeen Ranjan Kumar)
 - **Application of forecasting methods in social science research** on 14.12.2022. (Achal Lama)
 - **Introduction to R & regression analysis and diagnostics using R** on 13.12.2022. (Ranjit Kumar Paul)
- One lecture on **Computational challenges and opportunities in agricultural bioinformatics** was delivered on 15.12.2022 in the workshop on Current trends in Agricultural Bioinformatics at ICAR-NAARM during December 14-16, 2022. (K.K. Chaturvedi)
- One lecture on **Multivariate techniques** was delivered on 28.12.2022 to the participants National workshop on Data Science & Big Data Analytics using R organized jointly by Department of Statistics & Population Research Center, Andhra University in association with four renowned research forums namely International Indian Statistical Association (IISA), Indian Society for Probability and Statistics (ISPS), Operational Research Society of India (ORSI) and Society of Statistics, Computer and Applications (SSCA) during December 27-28, 2022. (Susheel Kumar Sarkar)

PARTICIPATION

International Conference/ Workshop/Symposium etc.

- Nine days International **Ensembl Browser** Workshop in virtual mode during October 03-11, 2022. (Sneha Murmu)
- International Conference on **Global Okra Round Table (GORT)** at National Agricultural Science Complex (NASC), New Delhi during October 10-12, 2022. (M.A. Iquebal and Sarika)
- International Conference of the Indian Ecological Society on **Sustainable Agricultural Innovations for Resilient Agri-Foods System** at SKUAST, Jammu (Jammu & Kashmir) during October 13-15, 2022. (Rahul Banerjee)
- 7th International Conference on **Opportunities and Challenges in Agriculture, environmental and Biosciences for Global Development** (OCAEBGD-2022), Goa during October 29-31, 2022. (Kaustav Aditya)
- **TropAg** conference at the Brisbane Convention and Exhibition Centre in Australia from October 31-November 02, 2022. (Susheel Kumar Sarkar)
- IEEE International Conference on **Computing, Communication, and Intelligent Systems (ICCCIS-2022)** at Greater Noida, India, Sharda University on November 04-05, 2022. (Sudeep, Alka Arora, Ramasubramanian V, K.K. Chaturvedi, Anshu Bharadwaj, Mukesh, SN Islam, Soumen Pal, R.K. Paul, Shashi Dahiya, Rajeev Ranjan Kumar, Kaustav Aditya, Ankur Biswas, Chandan Kumar Deb, Raju Kumar, Deepak Singh, Madhu, Pankaj Das, Rahul Banerjee, Bharti, Prakash Kumar)
- VIIth International Conference on **Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2022)** at BAU Ranchi during November 21-23, 2022 (online). (Deepak Singh, Bharti, Pankaj Das)
- International Conference on **Intelligent Vision and Computing (ICIVC 2022)** at NIT Agartala on November 26-27, 2022. (Akshay Dheeraj)
- International Conference (online) on **System of Crop Intensification (ICSCI 2022)** for Climate-Smart Livelihood and Nutritional Security at ICAR-Indian Institute of Rice Research, Hyderabad during December 12-14, 2022. (M.A. Iquebal and Sarika)
- Eighth International Conference on **Statistics for Twenty-First Century-2022 (ICSTC – 2022)** organized by the International Statistics Fraternity (ISF), School of Physical and Mathematical Sciences and Department of Statistics, University of Kerala, Trivandrum during December 16-19, 2022. (Prakash Kumar, Kaustav Aditya, Ankur Biswas, Pankaj Das and Anindita Datta)
- International **India Statistical Association** conference (IISA-2022) organized by Indian Institute of Sciences, Bengaluru during December 26-30, 2022. (R.K. Paul, Sukanta Dash and Md. Harun)
- International Conference (online) on **Knowledge Discoveries on Statistical Innovations & Recent Advances in Optimization** at Department of Statistics and Population Research Centre, Andhra University, Visakhapatnam during December 29-30, 2022. (Soumen Pal, R.K. Paul)

National Conference/ Workshop/ Seminar/ Symposia/ Training/Foundation Course/Annual Day/Lectures, etc.

- National Workshop on **Developing/Reviewing Sub-National Level Monitoring Framework for SDGs** organized by Ministry of Statistics and Programme Implementation at SCOPE Convention Centre, New Delhi on October 31, 2022. (Nominee of Secretary DARE and DSG ICAR). (Rajender Parsad)
- Training workshop on **Statistical Modelling Theory and Application** organized by Society of Statistics, Computer and Applications (SSCA) and Department of Statistics, Manipur University, Manipur on October 31, 2022. (D.C. Mishra)
- 73rd Annual Conference of Indian Society of Agricultural Statistics on **Statistics and Machine Learning for Big Data Analytics** organized in collaboration with Division of Agricultural Statistics, FOH, SKUAST-K, Srinagar during November 14-16, 2022. (Rajender Parsad, Anil Rai, Tauqueer Ahmad, Sudeep, Ramasubramanian V, KK Chaturvedi, Alka Arora, SN Islam, Anshu Bharadwaj, Mukesh, RK Paul, Shashi Dahiya, Kaustav Aditya, Ankur Biswas, Rajeev Ranjan Kumar, Soumen Pal, Chandan Kumar Deb, Madhu, Pankaj Das, Raju Kumar, Deepak Singh, Rahul Banerjee, Bharti, Prakash Kumar)
- **Gyanotsav 2022** at NASC Complex, New Delhi on November 17-19, 2022. (Rajender Parsad, Sudeep, Alka Arora, SN Islam, Anshu Bharadwaj, Soumen Pal, Shashi Dahiya, Chandan Kumar Deb, Sanchita Naha, Madhu,

Md. Ashraful Haque, Akshay Dheeraj, Samarth Godara)

- Online workshop cum Hands-on-Training for **Implementation of Academic Management System** organized by Odisha University of Agriculture and Technology, Bhubaneswar during December 07-08, 2022. (Sanchita Naha)
- Technical Workshop on **Proposed Centre of Excellence in Agricultural Economics and Statistics** organized by ICAR and World Bank on December 12, 2022 at KAB II. (Rajender Parsad)
- National Workshop of **AICRP on LTFE** organised at Dr PDKV Akola on December 16, 2022. (Anindita Datta)
- पूर्वानुमान एवं कृषि प्रणाली मॉडलिंग प्रभाग द्वारा दिसम्बर 20–22, 2022 के दौरान आयोजित ऑनलाइन तीन दिवसीय हिन्दी कार्यशाला “कृषि आंकड़ों के लिए समय श्रृंखला पूर्वानुमान और मशीन लर्निंग मॉडल का अवलोकन” में सहभागिता की। (Prakash Kumar)

Meetings

- XXVI Meeting of Regional Committee No. 2 for States of West Bengal, Odisha, Telangana, Andhra Pradesh and Andman Nicobar Island organized by ICAR-NRRI, Cuttack on October 14, 2022. (Rajender Parsad)
- NAAS Meeting for scrutinizing and short listing of nominations for Academy Awards on October 20, 2022. (Rajender Parsad)
- PRSG, 3rd Review meeting for the project Implementation of Interactive Information Dissemination System (IIDS) with Indian Council of Agricultural Research (ICAR) in Meity under the Chairmanship of JS (Meity) on October 31, 2022. (Anil Rai)
- First Meeting for Krishi Kalyan Schemes on November 01, 2022 Chaired by DDG (Agricultural Education), ICAR. (Rajender Parsad)
- VISMD Meeting on November 18, 2022. (Rajender Parsad, Anil Rai, Mukesh Kumar, KK Chaturvedi, SB Lal and Sanjeev Kumar)
- ICT Steering Committee Meeting held on December 05, 2022. (Rajender Parsad)
- 3rd Steering Committee Meeting of Netsfcon held on December 08, 2022. (Rajender Parsad, Tauqueer Ahmad and Deepak Singh)
- Meeting of Agriculture University Ranking Committee on December 08, 2022. (Rajender Parsad)
- Executive Committee Meeting of National Academy of Agricultural Sciences on December 16, 2022. (Rajender Parsad)
- राजभाषा कार्यान्वयन समिति on December 27, 2022. (Rajender Parsad)
- Chaired 70th Institute Management Committee Meeting held on December 28, 2022. (Rajender Parsad)
- Meeting on discussion on OOMF indicators chaired by Honourable Secretary DARE and DG, ICAR on December 28, 2022. (Rajender Parsad)
- Executive Committee Meeting of National Academy of Agricultural Sciences on December 16, 2022. (Rajender Parsad)

HUMAN RESOURCE DEVELOPMENT

Training Programmes/Workshops Organized: 07 (254 Participants)

S. No.	Title	Venue	Period	No. of Participants
1.	Training programme on Metagenomic Data Analysis under CRP Genomics Platform (Coordinators: Anu Sharma, Md. Samir Farooqi and Ritwika Das)	ICAR-IASRI, New Delhi (Online)	October 18-21, 2022	33
2.	CAFT Training Programme on Prominent Statistical tools for Data Science in Agriculture using R and Python under the aegis of Education Division, ICAR (Coordinators: R.K. Paul)	ICAR-IASRI, New Delhi	October 09-29, 2022	25

3.	RNA World: Advance Bioinformatics for Deciphering Regulatory Molecules (Coordinators: Anu Sharma, Samir Farooqi and Ritwika Das)	ICAR-IASRI, New Delhi (Online)	November 03-09, 2022	53
4.	AMS training at SKUAST, Srinagar under NAHEP (Coordinator : Sudeep Marwaha)	ICAR-IASRI, New Delhi	November 10-11, 2022	30
5.	Computer Applications for Technical Personnel of ICAR (Coordinators: Shashi Dahiya, Chandan Kumar Deb and Akshay Dheeraj)	ICAR-IASRI, New Delhi (Online)	December 15-21, 2022	49
हिन्दी कार्यशाला				
6.	साइबर जागरूकता (समन्वयक: सुभाष चंद्र एवं जय भगवान)	भाकूअनुप-भाकूसांअसं, नई दिल्ली (ऑन-लाइन)	अक्टूबर 06, 2022	47
7.	कृषि आंकड़ों के लिए समय श्रंखला पूर्वानुमान और मशीन लर्निंग मॉडल का अवलोकन (समन्वयक: विशाल गुरुंग, कंचन सिंह एवं अचललामा)	भाकूअनुप-भाकूसांअसं, नई दिल्ली (ऑन-लाइन)	दिसम्बर 20-22, 2022	17

Other Sensitization Programmes Organized/Sponsored

- Operationalization of AMS, Virtual Classroom, AR/VR and other activities on-going under NAHEP Component-2 Project was organized at RLBCAU Jhansi on October 19, 2022 and November 23-24, 2022. (Rajender Parsad, Mukesh Kumar, Alka Arora and , Anshu Bharadwaj)



- Sponsored two training programmes for Scheduled Caste farmers on **Agroforestry for Increasing Farmers' Income (fdl lka dh vlenuh c<kus grq d'f'lokdudh)** at ICAR-Central Agro-forestry Research Institute, Jhansi during October 17-19, 2022 and November 22-24, 2022. 25 farmers participated in each of the training programme. During these training programmes Digital Resources Useful for farmers were also shared by faculty from ICAR-IASRI, New Delhi.



CONSULTANCY/ADVISORY SERVICE PROVIDED

- Ramasubramanian V.** advised Dr. Babita Rani, Principal Scientist, Rohtak Centre of ICAR-CIFE, Mumbai on October 16, 2022 regarding variance stabilizing transformation of the response variable in fisheries data.
- Kaustav Aditya** advised (i) Dr. Parimal Sinha, Principal Scientist, Division of Plant Pathology, ICAR-IARI, New Delhi regarding data on CRD design and analysis for his project; (ii) Dr. Robin Gogoi, Professor, Division of Plant Pathology of ICAR-IARI, New Delhi on analysis of data and calculation of CD values of design of experiments and (iii) Dr. Yadvika, Associate Professor, CCS, HAU, Hisar on sample size determination.
- M.A. Iquebal** advised (i) Dr. Niranjana S, ICAR-IARI, New Delhi regarding SNP and GWAS analysis in wheat crop; (ii) Dr. Sharvan Singh, ICAR-IARI, New Delhi regarding GWAS analysis in core crops and (iii) Dr. (Ms.) Deeba Kamil, Senior Scientist, ICAR-IARI, New Delhi regarding transcriptome analysis of *Trichoderma* sp.
- Sarika** advised (i) Dr. Rajendra Kumar, Principal Scientist, ICAR-IARI, New Delhi regarding molecular data analysis; (ii) Dr. Reeta Bhatia, Senior Scientist, ICAR-IARI, New Delhi regarding molecular data analysis in floriculture and (iii) Dr. MS Saharan, Principal Scientist, ICAR-IARI, New Delhi regarding molecular data analysis.
- Mohd. Harun** advised Dr. Ashish Kumar Gupta, Principal Scientist at ICAR-National Institute for Plant Biotechnology, New Delhi regarding analysis of data acquired during an investigation of 453 exotic and indigenous accessions representing the genetic diversity of Brassica species during 2019-2022 crop seasons. Thirteen major pathotypes/races of *A. candida* representing major mustard growing hot spot locations across the India were used in this study. Simultaneously, multi-locational field testing was also done at adult plant stage in agro-climatically diverse locations. Correlation and principal component analysis was done to decipher the relationship between the resistance against the white rust pathogen at cotyledonary, true leaf and adult plant stage. GGE biplot analysis was used to understand the relation between environment and genotypes against the disease.
- Bishal Gurung** advised (i) Dr. Ampee Tasung, Scientist, ICAR-NEH, Arunachal on the use of ANOVA, t-test

and correlation studies; (ii) Ms. Nandini Roy, Ph.D., student, Social Science, UBKV, West Bengal on the use of random forest for finding cause and effect relationship and ANOVA technique for her data and (iii) Sh. Vikono Ksh, Ph.D. student ICAR- IARI, New Delhi on the use of randomised central composite design for her research work.

- **Rahul Banerjee** advised (i) Dr. Shantakar Giri, Scientist-D, Regional Sericultural Research Station (RSRS), Central Silk Board, Dumka, Jharkhand on exploratory data analysis and the distribution of different nutrient content in the leaves of Arjun (*Terminalia arjuna*) and Asan (*Terminalia elliptica*) plants and (ii) Dr. Suddhasatwa Maitra Mazumdar, Scientist-C, BSMTK Kathikund, BTSSO Bilaspur, Central Silk Board on fitting of Exponential, Gompertz and Monomolecular growth models for the analysis of data on Exophily of *Culicoides* spp. (Diptera: Ceratopogonidae) vectors of bluetongue disease of cattles.

AWARDS AND RECOGNITIONS

Awards

Ankur Biswas

- **Professor R.N. Pillai Best Paper Presentation Award – 2022** for the paper entitled “Proportion estimation under geographically weighted logistic regression model from survey data” in the Eighth International Conference on Statistics for Twenty-first Century-2022 (ICSTC-2022) from December 16-19, 2022, organized by International Statistics Fraternity (ISF), School of Physical and Mathematical Sciences and Department of Statistics, University of Kerala, Trivandrum.

Ankur Biswas, Deepak Singh

- **InSc Young Researcher Award 2022** by InSc Institute of Scholars. The award is given on the quality of research work published in reputed national or international research journals.

Bishal Gurung

- **Best Scientist Award in Agricultural Statistics** at 7th International Conference on “Opportunities and Challenges in Agriculture, Environmental & Biosciences for Global Development (OCAEBGD-2022)” organized at Conference Hall, St. Joseph Vaz Spiritual Renewal Centre, Cruz Dos Milagres, Old Goa, Goa during October 29-31, 2022.

Kaustav Aditya

- **Certificate of the Session Award for best Oral presentation** at 7th International Conference on Opportunities and Challenges in Agriculture, Environmental and Biosciences for Global Development (OCAEBGD-2022), Goa during October 29-31, 2022.

Anindita Datta

- **Dr. GR Seth Memorial Young Scientist Award-2022** at 73rd annual conference of Indian Society of Agricultural Statistics.
 - Anindita Datta, Seema Jaggi, Cini Varghese, Eldho Varghese, Mohd. Harun and Arpan Bhowmik. Row-column designs with multiple units per cell balanced for spatial effects.



Pankaj Das

- (i) **Dr. G.R. Seth Memorial Young Scientist Award** at 73rd Annual Conference of Indian Society of Agricultural Statistics organised by Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K), Srinagar during November 14-16, 2022.
- (ii) **Best oral presentation award** in the VIIth International conference on Global Research Initiatives for Sustainable Agriculture and Allied Sciences (GRIAAS-2022) at BAU, Ranchi during November 21-23, 2022.



Recognitions

Rajender Parsad

- **Chief Guest**, on the occasion of Valedictory function of 03 days training programme organized for the Schedule cast farmers under the Schedule caste sub plan on **Role of Agroforestry in increasing Farmer's Income** organized by ICAR-Central Agroforestry Research Institute, Jhansi during October 19-21, 2022 under the aegis of SC Sub Plan of ICAR-IASRI, New Delhi.
- **Member**, Advisory Committee for 73rd Annual Conference of Indian Society of Agricultural Statistics organized on **Statistics and Machine Learning for Big Data Analytics** by Division of Agricultural Statistics, FOH, SKUAST-K, Srinagar during November 14-16, 2022.
- **Guest of Honour** during Inaugural function of 73rd Annual Conference of Indian Society of Agricultural Statistics organized on **Statistics and Machine Learning for Big Data Analytics** by Division of Agricultural Statistics, FOH, SKUAST-K, Srinagar during November 14-16, 2022.
- **Convener**, 56th Dr. Rajendra Prasad Memorial Lecture on Statistics, AI/ML and Big Data Analytics delivered by Dr. GP Samanta, Chief Statistician of India and Secretary Ministry of Statistics and Programme Implementation and 41st Dr. VG Panse Memorial Lecture on Paradigm Shift in Agricultural Education to Meet Agriculture Revolution 4 in the 73rd Annual Conference of Indian Society of Agricultural Statistics organized on **Statistics and Machine Learning for Big Data Analytics** by Division of Agricultural Statistics, FOH, SKUAST-K, Srinagar during November 14-16, 2022.
- **Guest of Honour** during Launch of Academic Management System at OUAT, Bhubaneswar on December 07, 2022.

Anil Rai

- **Chairman**, Digital / Hi-Tech Agriculture “Technical Working Groups for assisting the UT Level Apex Committee (UTLAC) to frame the comprehensive Agriculture Policy for holistic Development of Agriculture and Allied Sectors in UT of J&K”.
- **Chairman**, Technical Session on Big Data Analytics, Machine Learning, Artificial Intelligence and their Applications in Agriculture in 73rd Annual Conference of ISAS held in SKUAST, Srinagar from November 14-16, 2022.

R.K.Paul

- **Fellowship** of Indian Society of Agricultural Statistics in the 73rd annual conference of Indian Society of Agricultural Statistics organized by Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar during November 14-16, 2022.

Susheel Kumar Sarkar

- **Chairman**, Contributed Paper presentation session CP03 on Inference and Multivariate/ Methods jointly with Dr. Ranjit Kumar Paul during 73rd annual conference of Indian Society of Agricultural Statistics at Sher-E-Kashmir University of Agricultural Sciences and Technology, Kashmir, J&K, during November 14-16, 2022.

SKUAST KASHMIR HOSTS 73rd ANNUAL CONFERENCE OF ISAS

Srinagar Nov. 15, 2022: The Division of Agricultural Statistics, Faculty of Horticulture, SKUAST-Kashmir is organizing three days 73rd Annual Conference of Indian Society of Agricultural Statistics, New-Delhi on Statistics and Machine Learning for Big Data Analytics w.e.f from 14th to 16th November. The Chief Guest of the function, Prof. G.P Samanta Chief Statistician of India and Secretary Ministry of Statistics and Programme Implementation, Govt of India in his address briefed that more precise statistical tools are required to assess the impact and challenges in agricultural sector at regional as well as national Level. Guest of honor, Professor R.C. Agrawal, DDG (Agricultural Education), ICAR, New Delhi in his address briefed about the importance of big data analytics in the field of agriculture and stressed on importance of proper statistical methodology. The Chief Patron of the inaugural function, Prof. Nazir Ahmad Ganai, Vice Chancellor, SKUAST-Kashmir in his address deliberated that the role of machine learning and big data will be a game changer in decision making in context to future policy and planning. He also deliberated that emerging concept of smart farming makes agriculture more efficient and effective with the help of high precision algorithms, which has emerged with big data technologies and high-performance computing to create new opportunities to unravel, quantify and understand data intensive processes in agricultural operational environments.



Executive President of the Society Prof. Padam Singh and Dr. Rajender Parsad, Director, ICAR IASRI, New Delhi in their address briefed about the origin and contributions of ISAS in the field of agriculture and allied sectors with basic objective to disseminate research conducted in Agricultural Statistics to meet the challenges in agricultural research in the country. Earlier, Prof. M.S. Pukhta, Head of the Division welcomed all the dignitaries as well as participants and also deliberated the audience about other activities conducted in the Division. The conference is being attended by the eminent scientists across the country from various premier institutes of India. More than 200 participants registered in the present conference which is being organized in hybrid mode (offline/online). 56th Dr. Rajendra Prasad Memorial Lecture was delivered by Prof. GP Samanta Chief Statistician of India and Secretary Ministry of Statistics and Programme Implementation on “Statistics, Artificial Intelligence, Machine Learning and Big Data Analytics”. 41st Dr. V.G Panse Memorial Lecture was delivered by Dr. R.C. Agrawal, DDG (Education) ICAR, New Delhi on “Paradigm shift in Agricultural education to meet Agriculture Revolution”. Dr. Imran Khan, Associate Professor, Division of Agricultural Statistics, Faculty of Horticulture, SKUAST- Kashmir.

PROJECTS/ SCHEMES/ PROGRAMME/ CENSUS/ SAMPLE SURVEYS/ EVALUATION STUDIES/ SOFTWARE DEVELOPED/ INITIATED/ COMPLETED

Initiated

1. 'Mining agricultural microbiome datasets for Antibiotic Resistance Genes (ARG) diversity and prediction of microbial resistome' w.e.f. October 03, 2022. (ICAR-IASRI: **Ratna Prabha**, Sunil Kumar; Associate Centre ICAR-NBAIM: Kumar M, Harsh Vardhan Singh, Abhijeet Shankar Kashyap, Jyoti Prakash Singh)
2. 'Model-assisted estimators using survey weighted artificial neural networks in complex surveys' w.e.f. October 10, 2022. (**Deepak Singh**, Raju Kumar, Samarth Godara, Bharti)
3. 'Development and assessment of conversational virtual agents 'Chatbots' for improving livestock, pet and poultry health and production' w.e.f. October 10, 2022. (Funded by ICAR-IVRI). (ICAR-IASRI: **Sanchita Naha**, Chandan Kumar Deb, Sudeep and Associate Centre ICAR-IVRI: Rupasi Tiwari)
4. 'Development of computational pipeline(s) for identification, characterization and functional analysis of ncRNAs in agriculturally important species' w.e.f. October 18, 2022. (**Sarika Sahu**, RatnaPrabha, Soumya Sharma)
5. 'Forest cover trend and above ground biomass estimation using advanced statistical technique based on remote sensing data' w.e.f. October 22, 2022. (ICAR-IASRI: **Md. Yeasin**, Ranjit Kumar Paul, Ajit; Associate Centre IIRS, Dehradun: Dipanwita Haldar)
6. 'Development of an integrated framework for the analysis of biogeochemical cycles from metagenomic data' w.e.f. November 28, 2022. (**Ritwika Das**, Sneha Murmu, Anu Sharma)
7. 'A novel approach for Time Series Forecasting of demand and supply of foodgrains in India' w.e.f. November 28, 2022. (**Wasi Alam**, Kanchan Sinha, Prawin Arya)
8. 'Development of robust estimator by integrating data from different surveys' w.e.f. November 28, 2022. (**Rahul Banerjee**, Pankaj Das, Raju Kumar, Ankur Biswas)

Completed:

1. Leveraging institutional innovations for inclusive and market led agricultural growth in Eastern India (Funded by NASF) completed on November 20, 2022. (R.K. Paul)
2. Explicating genomic insights of indigenous equines breed population through "Computational Genomics" and "Artificial Intelligence" based approaches. Funded by Inter-Institutional in collaboration with NRCE, Hisar completed on November 30, 2022. (Sarika, MA Iquebal, Dinesh Kumar (deputation on 02.12.2021))
3. Estimation of finite population proportion from Geo-referenced survey data completed on December 01, 2022. (Vandita Kumari (transferred as on 16.10.2021), Ankur Biswas (since 17.10. 2021), Pradip Basak (upto 30.11.2020), Hukum Chandra (expired as on 26.04.2021), Kaustava Aditya, Rahul Banerjee (since 23.11.2021), Deepak Singh (since 23.11. 2021)
4. Genome wide association study in Indigenous poultry breeds/varieties completed on December 31, 2022. (Anil Rai, D.C. Mishra)

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- MOU with CSIR-National Botanical Research Institute, Lucknow on 07.10.2022 for genomic data analysis generated on cotton crop related with boll weight QTL for cotton yield improvement.
- Letter of Agreement (LoA) with Food and Agriculture Organization of the United Nations-India (FAO-India) on 11.11.2022 and initiated a study entitled "*Study on reviewing the Food Loss Index (FLI) estimates for India and preparing assessment report for inclusion of the SDG Indicator 12.3.1 in the National Indicator Framework of India*" on 11.11.2022 funded by FAO-India.
- MOU with Agricultural Scientists Recruitment Board for development, implementation and functioning of Online Application & Scorecard Information System (OASIS) on 29.11.2022

PERSONNEL

Congratulations on your Promotion/ New Assignment/ New Joining

Name	Designation	Effective date
Sh. Vipin Dagar	U.D.C.	28.10.2022 (Joined on deputation for one year)

Wish you a Happy Retired Life

Name	Designation	Effective date
Sh. Pramod Kumar	Chief Technical Officer	31.12.2022

Transfer/ Resignation/Deputation/Relieved

Name	Designation	Effective date
Dr. Harish Kumar H.V.	Scientist	17.10.2022 (transferred to ICAR-IIHR, Bengaluru)
Dr. Bharti Pandey	Scientist	29.12.2022 (transferred to ICAR-NDRI, Karnal)



Azadi Ka Amrit Mahotsav

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