ICAR-IASRI NEWS

Volume 22 No. 4 January-March, 2018

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From Director's desk……

This Newsletter highlights the salient research achievements, training programmes conducted, workshops and conferences organized and other significant activities performed at the Institute during the period under report.

An attempt has been made to develop hybrid models by combining time series models viz., Auto-Regressive Integrated Moving Average i.e. ARIMA / ARIMA with eXplanatory variables i.e. ARIMAX and machine learning techniques viz., Artificial Neural Networks (ANN) / Support Vector Machines (SVM) for forecasting rice yield using weather based covariates (explanatory variables) namely, minimum temperature, maximum temperature and rainfall for Aligarh and Meerut districts of Uttar Pradesh. For this, time series has been considered as a function of linear and nonlinear components and ARIMA/ ARIMAX models were employed to fit and predict the linear component while the residuals have been predicted employing ANN/ SVM models. Eventually, the predicted linear and nonlinear components are combined to obtain aggregate prediction. The proposed hybrid approach was found to be better than the traditional time series models in terms of their forecasting performance.

In another study, performance assessment of education in five north Indian based agricultural universities have been done. For this, a Self-Assessment Report (SAR) questionnaire was formulated and the categorical data obtained were analyzed using Multinomial Logistic Regression, Spearman Correlation and some non-parametric methods. The results revealed that student's choice of academic programmes is influenced by the rank of programme (rank based on number of students passed in last five years) and their own education level whereas there is no statistically significant relationship between the type of academic programme attended with gender. Since selected universities were of different categories, thus results and interpretation differed individually.

Our Scientists have brought laurels to the institute by way of delivering talks as invited speakers at various national and international conferences of repute within India. One of our young and budding Scientist has presented a paper in "Latin American Conference On Statistical Computing" held at University of Costa Rica, San Jose.

Six training programmes were conducted on a wide range of topics viz., Statistical modeling and forecasting, Statistical techniques/ Advances for agricultural data analysis, OMICS tools for agricultural germplasm improvement, Analysis of experimental data and Computational and statistical advances for analysis of biological data in agriculture. It will be heartening to note that our institute has conducted two workshops exclusively in Hindi.

I am also glad to announce that a good number of publications has come out during this period. Many computer packages and mobile apps have been developed, to mention a significant one, a software named Variety Identification System for *Triticum aestivum* (Wheat). I am extremely delighted to inform you all that two Mobile Apps (Animal Reproduction and Pig Farming) and Education Portal of ICAR *(http://education.icar.gov.in)* developed by our institute were launched by Hon'ble Union Minister of Agriculture and Farmer Welfare Shri. Radha Mohan Singh on March 08, 2018 during Director's Conference at NASC Complex, New Delhi.

It is hoped that the contents of this Newsletter would be informative and useful. Any suggestion for improving the contents of the newsletter is always welcome.

(Lalmohan Bhar)

ICAR-IASRI NEWS
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RESEARCH ACHIEVEMENTS

Development of Hybrid Time Meries Models Using Machine Learning Techniques For Forecasting Crop Yield With Covariates.

Wasi Alam, Mrinmoy Ray, Santosha Rathod, Kanchan Sinha, Rajeev Ranjan Kumar, K.N. Singh.

In a developing country like India, food security means making available minimum quantity of food grains to the entire population. Despite the fact that India has made a satisfactory achievement in food grains production, its population growth has nullified the benefits of production. The FAO forecasts that global food production will need to increase by over 40% by 2030 and 70% by 2050 (FAO, 2009). Among food grains, rice is the most important crop of the developing world and the staple food for more than 60% of the Indian population. In India, the annual compounded growth rate of rice production has declined from 3.55 per cent during 1981-90 to 1.74 per cent during 1991-2000. Projection of rice demand by 2030 mentioned in Vision 2030 of Central Rice Research Institutehas been computed on the basis of fixed historical growth rate. This approach is quite adhoc and having no sound statistical foundation. Forecasting the future demand/supply of crop production to meet the need of corresponding future growing population is a major concern for policy planners. Production is simply multiplication of cropped area with yield. Here, we have tried to forecast yield. In order to get more reliable future crop production forecast, we need more precise time series forecast of yield. In this work, we have tried to forecast yield with two approaches, in one approach we have used weather covariates (minimum temperature, maximum temperature and rainfall) which effect the yield values and in another approach we have not used any covariates. Traditionally, classical autoregressive integrated moving average (ARIMA) model hasbeen widely used for short term time series forecasting. In ARIMA approach, the future value of a variable is assumed to be a linear function of several past observations and random errors. Classical ARIMA models are typically well-suited for short-term forecasts, but not for long term forecasts due to the convergence of the autoregressive part of the model to the mean of the time series. Moreover, this approach does not explain the nonlinear component of residuals obtained through ARIMA model. Here, we have tried to improve the performance of ARIMA through the hybrid approach initially and the improved forecast values have been used for long term forecast through the proposed technique mentioned in next section. Inhybrid approach, we consider time series (y_t) as a function of linear and nonlinear components. Hence

$$y_t = f(L_t, N_t)$$

where L_t and N_t represents the linear and nonlinear components, respectively. The relationship between linear and nonlinear components can be written as follows:

$$y_t = L_t + N_t$$

The main strategy of this approach is to model the linear and nonlinear components separately by different models. The methodology comprises of three steps. Initially, an ARIMA model is employed

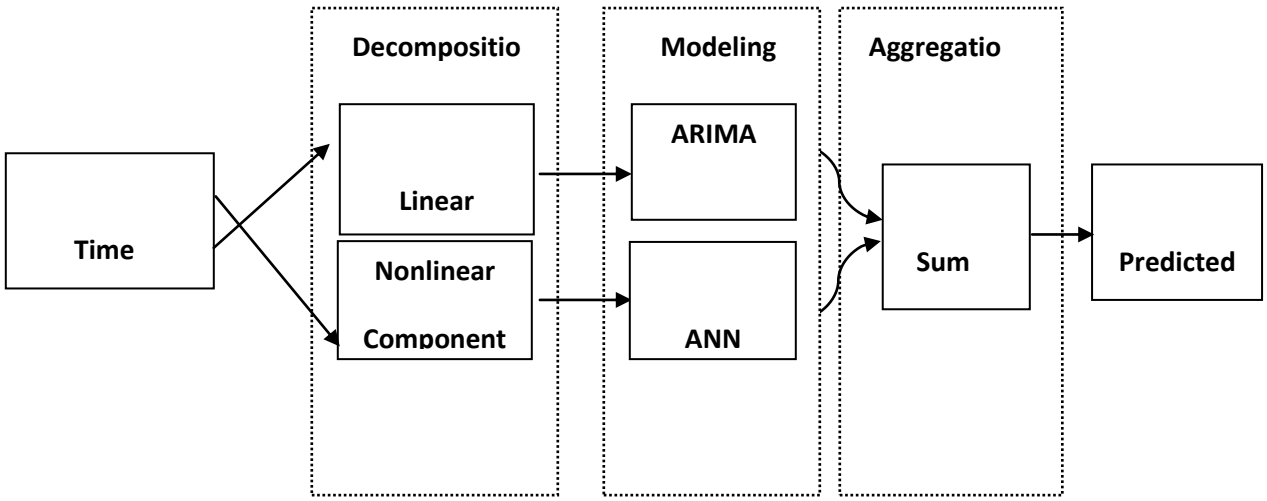
to fit the linear component. Let the prediction series provided by ARIMA model bedenoted as $\hat{L}_t$. In the second step, rather than predicting the linear component, the residuals denoted as e_t which are nonlinear in nature are predicted. The residuals can be gotten by subtracting the predicted value $\hat{L}_t$ from actual value of the considered time series y_t.

$$e_t = y_t - \hat{L}_t$$

Now the residuals are predicted employing an ANN model. Let the prediction series provided by ANN model i.e. denoted as $\hat{N}_t$. Eventually, the predicted linear and nonlinear components are combined to generate aggregate prediction.

$$\hat{y}_t = \hat{L}_t + \hat{N}_t$$

The ARIMA-ANN hybrid approach is graphically shown below,



Proposed approach for Long term forecast

As we know univariate linear time series approaches like ARIMA or ARIMAX provides short term H-step ahead forecast. In H-step ahead forecasting, we learn H different models of the form $y_{t+h}=f_h(y_t,\ldots,y_{t-n+1})+\epsilon_{t+h}$, for forecast h>H, we have proposed the following iterative steps for long term forecast through hybrid time series models through machine learning approaches:

1. Select the suitable ARIMA/ARIMAX model and obtain the fitted values of yield along with the residuals.

2. Select the best ANN model for the residuals on the basis of minimum values of forecast accuracy measure (MAE or MAPE) and correct the fitted values of yield obtained via ARIMA/ARIMAX model through the fitted residuals estimated by the selected ANN model.

4. Compute the MAPE for the fitted values of yield through ARIMA/ARIMAX and hybrid approach.

5. If MAPE for hybrid approach is less than ARIMA/ARIMAX model, use the hybrid approach for long term forecast in the following way:

    a. Obtain the short term out of sample forecast of yield through the selected ARIMA model using the corrected yield as baseline data.
    b. Forecast the residuals up to the desired forecast horizon by the suitable ANN model.
    c. Obtain baseline data by correcting the short term forecast values of yield (obtained by ARIMA model) through the forecasted residuals using the selected ANN model.
    d. Select suitable ARIMA model on the basis of baseline data and obtain short term forecast of the yield up to the desired forecast horizon.
    e. Consider the baseline data obtained as above for further long term forecast.
    f. Repeat steps i-v until we get the forecast of the desired forecast horizon.

In order to enhance the performance of the ARIMA model for forecasting rice yield, ANN and SVM were applied on the residuals of the selected ARIMA model. For the purpose, we have used time series data of Aligarh and Meerut districts of Uttar Pradesh from 1975 to 2013. ARIMA (2,1,0) model was selected as suitable model for the Aligarh district and MAPE for hybrid ARIMA(2,1,0)-ANN was found to be 4.65% as compare to 17.677% of ARIMA(2,1,0). MAPE for hybrid ARIMA(2,1,0)-SVM was found to be 2.94% as compare to 17.677% of ARIMA (2,1,0) and 4.65% of hybrid ARIMA-ANN. Hence, the performances of hybrid ARIMA- ANN and ARIMA-SVM were found to be better than that of ARIMA (2,1,0), both under training as well as testing data sets. To understand the performance of hybrid ARIMA approaches using machine learning techniques as compare to ARIMA, ANN and SVM on different data set, we applied these approaches on the rice yield data for the Meerut district of Uttar Pradesh. ARIMA (1,1,0) model was found to be suitable one for the yield data. Estimated MAPEs for ARIMA (1,1,0), ANN (02:06:1*l*), SVM, ARIMA-ANN and ARIMA-SVM under training set of the data were found to be 7.72, 3.09, 2.26, 2.08 and 1.79, respectively, however, estimated MAPE under validation set of the data were found to be 5.83, 4.65, 3.63, 2.94 and 1.48 for ARIMA (1,1,0), ANN, SVM,ARIMA-ANN and ARIMA-SVM, respectively. We also applied ARIMAX model on rice yield data along with rainfall, minimum temperature and maximum temperature as exogenous variables. On the basis of minimum values of goodness of fit, ARIMAX(0,1,1) model with rainfall as exogenous variable was found to be the suitable one as AIC and BIC are 7.02 and 11.688, respectively. P-vales of parameter estimates of ARIMAX(0,1,1) and rainfall as exogenous variable are estimated to be <0.0001 and 0.0312, respectively. Residuals were found to be white noise. Hence, the ARIMAX(0,1,1) model was found to be suitable model under rainfall as exogenous

variable. MAPE under ARIMAX(0,1,1) model with rainfall as exogenous variable was estimated to be 12.18 as compare to 17.68 under usual ARIMA(2,1,0) model. ANN approach was also applied on the residuals of ARIMAX(0,1,1) for modeling and forecasting of the residuals. ANN model with 06:04s:1/ (06 time delay and 04 hidden nodes) was identified as suitable model as this model was having minimum values of MAE i.e. 0.005 and 0.018 under training and testing sets of data, respectively. Using 06:04s:1/ model, estimated the fitted values of residuals and these fitted residuals were used to correct the fitted values of yield obtained through ARIMAX(0,1,1) model and eventually get the fitted values under hybrid ARIMAX(0,1,1) model. MAPE under the hybrid ARIMAX(0,1,1)-ANN is estimated to be 0.37 as compare to 12.18 under ARIMAX(0,1,1) model. SVM was also applied on the residuals of the ARIMAX(0,1,1) model and got fitted residuals by SVM and the fitted values of yield obtained by ARIMAX(0,1,1) model were corrected by the fitted residuals of SVM. The MAPE for the corrected yield using fitted residuals of SVM is estimated to be 1.11. The significant reduction in MAPE from 12.18 (MA1,1) to 0.37 and 1.11 through ARIMAX(0,1,1)-ANN model and ARIMAX(0,1,1)-SVM, respectively, indicates a significant improvement in the performance of ARIMAX model using machine learning techniques. On the basis of these encouraging results for the two districts (Aligarh and Meerut) of Uttar Pradesh, hybrid ARIMA and ARIMAX using machine learning techniques can be recommended for yield forecast as it has caused significant reduction in MAPE both under training as well as testing sets of data.

Performance Assessments of Universities in Agriculture Education: A comparative analysis

Sukanta Dash and Anil Kumar

This article mainly deals with Performance Assessments of selected five northern Universities of ICAR in Agricultural Education. In this regards we and our expert team have prepared a Self-Assessment Report (SAR) and analyzed the data using some statistical methodology to deal with categorical dependent variable like Multinomial Logistic Regression, Spearman Correlation and some non-parametric methods. Finally after going through the interpretation some recommendations have also been given.

The key objective of the performance assessment is to contribute to major/significant improvement of the universities involved in the agricultural education. 'Significant improvement' means improvement of the substance or essence of the universities. Participation in the performance assessment process affirms the universities responsibility for the quality of education offered, and demonstrates its commitment to continuous improvement.

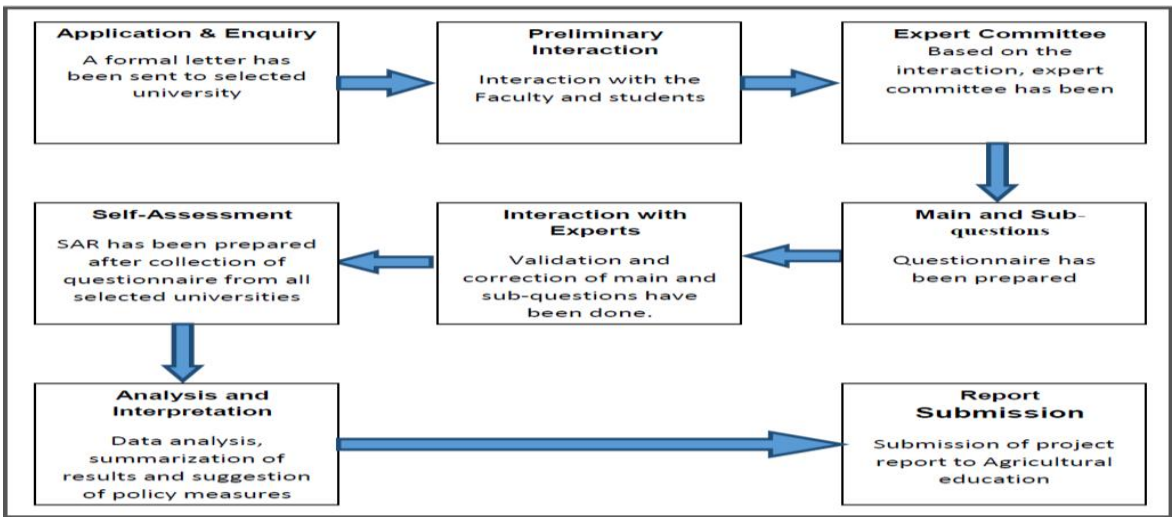
The performance assessment accelerates quality improvement for individual universities associated with agricultural education. It is often seen as an instrument of the strategic development and an effective way to influence university management teams to establish a clear agenda for change and improvement.

The universities entering the performance assessment process recognize that there are a lot of details about their performance, both good and bad, that are brought to their notice for the first time

while preparing their Self- Assessment Reports. Often, as good academicians, we subject our own university to criticism. By undergoing self-evaluation, a university assesses planning and goal-setting processes, and measures accomplishments against objectives. However, it is often done informally and on the basis of incomplete and involuntarily biased information. The self-assessment phase allows a university to go through this process in an orderly and coherent manner that facilitates detection of actual problems and facilitates the university to develop its own solutions.

The peer review committee visited selected universities two to three times and then collected the information. First, it creates a sense in the university that quality assurance is a real concern which must be shared by all. Second, by means of questions and suggestions, those interviewed get insights on ways to improve the areas they are responsible for. Finally, through an oral debriefing plus a written report, the expert committee provides a thorough assessment of the quality of the university as well as required or suggested actions for improvement. The expert committee also provides advice and counsel, with regards to improvement of university management.

The area of research work is confined to five different universities present in northern part of India. The following actions are recommended in designing and implementing the Performance-Assessment process (i) The universities should appoint a project leader and an Accreditation committee to manage the process and draft the report, (ii) At an early stage, the management team will need to provide a full explanation within the universities of the aims of the Performance-Assessment exercise and of the standards against which the universities is measuring performance. The assessment process should involve all key stakeholders, who will need to understand the process if they are to contribute fully to the implementation of a plan for a rigorous Performance-Assessment, (iii) Methodology: A detailed plan for conducting the Performance-Assessment will need to be developed within no time of receiving communication in this regard. The universities will be required to develop a plan that meets its own specific needs.The procedure of performance assessment is given below.



In the first part of the work we have prepared an online form of questionnaire by taking care of all aspects of performance assessments. Then in the process of filling up the questionnaire, we have selected five state agriculture universities namely i. NDRI, Karnal, ii. Chaudhary Charan Singh Haryana Agricultural University, Hisar, iii. Maharana Pratap University of Agriculture & Technology, Udaipur, iv. Agriculture University, Jodhpur and v. Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut. As a result of performance assessments of all universities it was found that students choice of academic programmes is influenced by the rank of programme (rank based on number of students passed in last five years) and their own education level where as there is no statistically significant relationship between the type of academic programme attended with gender variation.

RECOGNITIONS

Anil Rai

- Acted as Member of interview board for selection of Scientist in Desert Medicine Research Centre (ICMR), Jodhpur during 04-05 January, 2018.

Rajender Parsad

- Chaired the session of Invited Talks on Information and Knowledge Management Systems on 30 January 2018 organized during the International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences (20th Annual Conference of Society of Statistics, Computer and Applications) at Department of Statistics, Pondicherry University, Puducherry during 29-31 January, 2018.

Hukum Chandra

- Invited Speaker in International Conference on Theory and Applications of Statistics and Information Sciences held at Coimbatore, Tamil Nadu during 05-07 January, 2018.
- Chaired an invited technical session in International Conference on Theory and Applications of Statistics and Information Sciences held at Coimbatore, Tamil Nadu during 05 – 07 January, 2018.
- Invited Speaker in International Conference on Changing Paradigms at Emerging Challenges in Statistical Science in conjunction with the Bi-Decennial Conference of the Society of Statistics, Computer and Applications held at Pondicherry University, Puducherry during 29-31 January, 2018.
- Chaired one contributed technical session in International Conference on Changing Paradigms at Emerging Challenges in Statistical Science in conjunction with the Bi-Decennial Conference of the Society of Statistics, Computer and Applications held at Pondicherry University, Puducherry during 29-31 January, 2018.
- Invited Speaker in National Seminar on Recent Advance in Statistics for Industries and Corporates at Department of Statistics, Anand, Gujarat during 10-11 February, 2018.
- Chaired one contributed paper session in National Seminar on Recent Advance in Statistics for Industries and Corporates at Department of Statistics, Anand, Gujarat during 10-11 February, 2018.

- Acted as Jury member to evaluate the papers presented for best paper award in National Seminar on Recent Advance in Statistics for Industries and Corporates at Department of Statistics, Anand, Gujarat during 10-11 February, 2018.
- Acted as Expert in Support for Statistical Strengthening Project (SSSP) at Directorate of Economics and Statistics, Odisha to explore the possibility of small area estimation on crop statistics and employment/ unemployment to generate disaggregate level estimate.
- Invited Speaker in International Symposium on Health Analytics and Disease Modeling, New Delhi, India during 08-09 March, 2018.
- Acted as Resource Person in National Workshop on Statistical Techniques and Data Analysis using R at Central University of Haryana, Mahendergarh, Haryana on 21 March, 2018.
- Acted as Expert, Annual Work Plan 2018-19 of the Population Research Centers (PRCs), Ministry of Health and Family Welfare, Government of India, New Delhi on 27-28 March, 2018.

Tauqueer Ahmad

- Acted as one of the Expert Members of Selection Committee at Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Srinagar to conduct interviews for Associate Professor in Statistics on 16 February, 2018.
- Acted as Member, Technical Advisory Committee for the Coverage Evaluation Survey, Ministry of Health and Family Welfare, Govt of India, Govt of India, New Delhi on 28 March, 2018.

Shashi Dahiya

- Chaired a contributory session on "Applied Statistics" on 31st of January'2018 organized during the International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences (20th Annual Conference of Society of Statistics, Computer and Applications) at Department of Statistics, Pondicherry University, Puducherry during 29-31 January, 2018.

VISITS ABROAD

- Dr. Arpan Bhowmik presented a contributed paper in III LACSC: Latin American Conference On Statistical Computing held from 27th Feb., 2018 to 02th March, 2018 in University of Costa Rica, San Jose, Costa Rica.

NEW PROJECTS/ SCHEMES/ PROGRAMMES/ CENSUS/ SAMPLE SURVEYS/ EVALUATION STUDIES INITIATED AND COMPLETED

Project Initiated

1. Estimation of breeding value using generalized estimating equation and Bayesian approach.(AGEDIASRISIL201800100110)
   Prakash Kumar, Himadri Shekhar Roy, LM Bhar, AK Paul.

(07.02.2018-29.01.2021)
2. A study on detection and interpretation of expression Quantitative Trait Loci (eQTL) mapping. (AGEDIASRISIL201800200111) Himadri Shekhar Roy, LM Bhar. RK Paul, P Kumar, AK Paul. (03.02.2018-02.02.2021)
3. Rice-metasys: understanding rice gene network for biotic and abiotic stress management through system biology approach. Funded by CABin Scheme. (AGEDIASRICOP201800300112) NRCPB: Amol Kumar U Solanke, SV Amitha Charu Rama Mithra. IASRI: DC Mishra, KK Chaturvedi. (01.03.2018- 31.03.2020)
4. Computational and experimental biology approaches for delineation of selected secondary metabolite pathways and antimicrobial peptides (AMPs) in major spices. Funded by CABin Scheme (AGEDIASRICOP201800400113). IISR: Johnson George K., T.E. Sheeja, R. Praveena, P. Umadevi, R. Sjvaranjani IASRI: U.B. Angadi (CCPI), Dinesh Kumar, M.A. Iquebal, Sarika. (05.03.2018-31.03.2020)
5. Deciphering genetic variation in the carbohydrate metabolism of farmed rohu families. Funded by CABin Scheme (AGEDIASRICOP201800500114) CIFA: J.K. Sundaray, S. Nandi, P.K. Meher, L. Sahoo, Kiran D., Khuntia Murmu, U.K. Udit, A.R. Rasal IASRI: Sarika (CCPI), Dinesh Kumar, M.A. Iquebal, U.B. Angadi. (05.03.2018-31.03.2020)
6. Genomic data analysis to elucidate the regulatory network and candidate genes underlying cytoplasmic male sterility in pigeonpea. Funded by CABin Scheme (AGEDIASRICOP201800600115) IIPR: A. Bohra IASRI:M.A. Iquebal (CCPI), Dinesh Kumar, Sarika, U.B. Angadi. (05.03.2018- 31.03.2020)
7. Computational approach for genomic resource improvement and precision phenotyping of less explored yield traits in Wheat. Funded by CABin Scheme (AGEDIASRICOP201800700116) IIWBR: Ratan Tiwari, Pradeep Sharma, Sonia Sheoran IASRI: Dinesh Kumar (CCPI), M.A. Iquebal, Sarika, U.B. Angadi. (05.03.2018-31.03.2020)

8. Computational biology approach for deciphering stress induced transcriptomic and proteomic changes rice-microbial interaction system. Funded by CABin Scheme. (AGEDIASRICOP201800800117)
   NBAIM: D.P. Singh, Renu, Sunil Kumar, Pramod Sahu
   IASRI: Sanjeev Kumar CCPI, K.K. Chaturvedi, Samir Farooqi.
   (06.03.2018-31.03.2020)
9. Investigations on stipe rust-defence response, identification of defence genes/QTLs associated with rust resistance in Wheat. (AGEDIASRICOP201800900118)
   NBPGR: Sundeep Kumar, Amit K. Singh
   IASRI: Monendra Grover (CCPI), D.C. Mishra, Neeraj Budhlakoti.
   (09.03.2018-31.03.2020)
10. Investigations on pathogenic microorganisms of shrimp aquaculture using metagenomic and other bioinformatic approaches. (AGEDIASRICOP201801000119)
    CIBA: Ashok Kumar Jangam, S.V. Alavandi, K. Vinaya Kumar R. Mary Lini, Satheesha Avunje
    IASRI: Monendra Grover.
    (09.03.2018-31.03.2020)
11. Development of web server for phenotype analysis for cattle breeding management. (AGEDIASRICIP201801100120)
    CIRC: Umesh Singh, Susheel Kumar, A.K. Das, T.V. Raja, Rani Alex
    IASRI: U.B. Angadi, Mir Asif Iquebal, Sarika, Dinesh Kumar
    (12.03.2018-11.03.2021)
12. Genomic and transcriptome sequencing of coriander (Coriandrum sativum) to reveal insight of its genomic architechture and breeding targets. Colloboration with Junagadh Agricultural University, Junagadh). (AGEDIASRICOP201801200121)
    JAU: Rukam Singh Tomar, M.V. Parakhia, Shradda B. Bhatt
    IASRI: M.A. Iquebal, Sarika.
    (4.03.2018-31.03.2021)
13. Study on heritability estimation. (AGEDIASRISIL201801300122)
    AK Paul, Himadri Sekhar Roy, LM Bhar, RK Paul
    (22.03.2018-21.03.2021)
14. 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, Samrendra Das, Upendra Kumar Pradhan
    (16.03.2018-15.03.2021)
15. Development of direct benefit transfer portal for DARE schemes. (AGEDIASRISIL201801500124)

Soumen Pal, Sudeep, Alka Arora (26.03.2018-25.03.2020)

Project Completed

1. Tobacco Agridaksh: An online expert system. (AGENIASRICIP201401800037) CTRI: H. Ravi Shankar, IASRI: N. Srinivasa Rao (24.09.2016), Sudeep (since 25.09.2016), ICAR-CTRI: Damodar Reddy, U. Sreedhar, K. Sivaraju, K. Sarala, S. Kasturi Krishna, M. Anuradha, IASRI: Sudeep (till 24.09.2016). (20.10.2014 - 19.01.2018)
2. Forecasting of spatio-temporal time series data using Space Time Autoregressive Moving Average (STARMA) model. (AGENIASRISIL201502300060) Mrinmoy Ray, Ajit, K.N.Singh and Bishal Gurung (Since 20.09.2015). (20.08.2015-19.02.2018)
3. Development of hybrid time series models using machine learning techniques for forecasting crop yield with covariates. (AGENIASRISIL201502000057) Kanchan Sinha (upto 22.08.2016), Mrinmoy Ray, Santosha Rathod, K.N. Singh and Rajeev Ranjan Kumar (Since 23.08.2016) (14.07.2015-22.02.2018)
4. A-optimal block designs for comparing test treatments with control treatment(s) - an algorithmic approach. (AGENIASRISIL201500200039) B. N. Mandal, Rajender Parsad, V.K. Gupta (till 16.03.2016), Sukanta Dash: 18.02.2015 - 19.03.2018
5. Performance Assessments of Universities in Agriculture Education: A comparative analysis. (AGEDIASRISOL201701800104) Sukanta Dash, Anil Kumar. (02.08.2017 - 31.03.2018)
6. Computational identification and modelling of genetic variation in relation to performance traits in buffaloes. (AGENIASRICOP201500900046) ICAR-CIRB: Punam Sikka, ICAR-IASRI: Dwijesh Chandra Mishra, ICAR-IASRI: A.R. Rao, K.K. Chaturvedi, ICAR-CIRB: K.P. Singh, S.S. Paul, A. Jerome, S. Balhara, Varij Nayan: 06.06.2015 - 31.03.2018
7. Smallholders' productivity and agricultural growth through technology, sustainable intensification and ecosystem services. (AGENIASRICIP201600800077) Girish Jha, IARI, IASRI: Prawin Arya. (13.04.2016 - 31.03.2018)
8. Whole Genome sequencing and development of Allied genomic research in two commercially important Fish - *Labeo rohita* and *Clarias batrachus*. Funded by DBT.(AGENIASRICOL201301400015) ICAR-NBFGR: N.S. Nagpure (till December 05, 2015), Basdeo Khushwaha (since December 06, 2015), ICAR-CIFA: Paramananda Das, Anand Agricultural University: Chaitanya G. Joshi, ICAR-IASRI: Dinesh Kumar, Anand Agricultural University: P. G. Koringa, ICAR-CIFA: P. Jayasankar, L. Sahoo, ICAR-NBFGR: Basdeo Kushwaha (till December 05, 2015), Ravindra Kumar, ICAR-IASRI: M.A. Iquebal (since 28.01.2014),

	Sarika (since 28.01.2014). (10.09.2013 - 31.03.20180)
9.	Transcriptome and proteome analysis for identification of candidate genes responsible for pistillate nature in castor. Funded by Extramural funded under Crop Sciences Division.(AGENIASRICOP201600400073) ICAR-IIOR : M. Sujatha, ICAR-IASRI: M.A. Iquebal. (01.01.2017 - 31.12.2019)

HUMAN RESOURCE DEVELOPMENT

Training Programmes Organized

S. N.	TITLE	VENUE	PERIOD	NUMBER OF PARTICIPANTS
1.	**CAFT programme on Recent Developments in Statistical Modeling and Forecasting in Agriculture** *Course Coordinator : Dr. K. N. Singh* *Course Co-Coordinator : Mr. Rajeev Ranjan Kumar*	ICAR-IASRI, New Delhi	28.12.2017 to 17.01.2018	**25**
2.	**Statistical Techniques for Agricultural Data Analysis for the technical personnel of ICAR/SAUs/CAUs under HRM unit, ICAR** *Course Coordinator : Dr. Susheel K Sarkar* *Course Co-Coordinator : Mr. Sunil K Yadav*	ICAR-IASRI, New Delhi	15.02.2018 to 24.02.2018	**11**
3.	**Application of OMICS Tools and Techniques for Agricultural Germplasm Improvement** *Course Coordinator : Dr. Sarika* *Course Co-Coordinator : Dr. Mir Asif Iquebal*	ICAR-IASRI, New Delhi	09.02.2018 to 01.03.2018	**24**
4.	**Statistical Advances for Agricultural Data Analysis** *Course Coordinaton : Dr. Seema Jaggi* *Course Co-Coordinator : Dr. Anindita Datta*	ICAR-IASRI, New Delhi	03.03.2018 to 23.03.2018	**25**
5.	**Analysis of Experimental Data sponsored by Bihar Animal Sciences University, Patna** *Course Coordinator : Dr. Rajender Parsad* *Course Co-Coordinator : Dr. Sukanta Dash*	Bihar Animal Sciences University, Patna	15.03.2018 to 17.03.2018	**25**
6.	**CAFT programme on Computational and Statistical Advances for Analysis of Biological Data in Agriculture** *Course Coordinator : Dr.Anu Sharma* *Course Co-Coordinator : Dr. S. B. Lal*	ICAR-IASRI, New Delhi	24.03.2018 to 13.04.2018	**20**

SEMINARS DELIVERED

- ORW seminars : 13
- Course Seminars : 15
- Project Completion Seminars : 3
- New Project Proposal Seminars : 3

CONFERENCES/ WORKSHOPS/ SYMPOSIA/ MEETINGS ETC. ORGANIZED

- Organized Grand Finale of Smart India Hackathon 2018 during 30-31 March, 2018 at Chandigarh Group of Colleges, Chandigarh. The event was jointly hosted by Department of Agricultural Research and Education (DARE) and Department of Agriculture Cooperation & Farmers Welfare, Ministry of Agriculture and Farmers Welfare. (Nodal Officer from ICAR/DARE cum Team Evaluation Judge: Sudeep Marwaha)
- Organized Hindi workshop on "Statistics and Informatics for Farmer's Welfare" in the institute (ICAR-IASRI) for the scientists on 20 January, 2018. (Seema Jaggi and Cini Varghese).
- Organized Hindi workshop on "Use of Computer in Agriculture" in the Institute (ICAR-IASRI) on 09 January, 2018. (Pal Singh and Sudeep Marwaha).

PUBLICATIONS

Research Papers

1. Arora, V, Kapoor, N, Fatma, S, Jaiswal, S, Iquebal, MA, Rai, A and Kumar, D (2018). BanSatDB: Whole genome based database of putative and experimentally validated microsatellite markers of three Musa spp. *Crop Journal*. https://www.sciencedirect.com/science/article/pii/S2214514118300205.
2. Bhattarai, M, Singh, G, Takeshima, H and Shekhawat, RS (2017). Farm Machinery Use and Agricultural Industries in India. *IFPRI discussion paper* 01715, *Washington, USA*.
3. Bhowmik, A, Varghese, E, Jaggi, S and Yadav, SK (2017). Designs for Animal experiments under two-way blocking structure in the presence of systematic trend. *Indian Journal of Animal Sciences* 88 (1): 121–124.
4. Chandra, H and Salvati, N (2018). Small Area Estimation for Count Data under a Spatial Dependent Aggregated Level Random Effects Model. *Communications in Statistics - Theory and Methods* 47 (5): 1234 -1255.
5. Chandra, H, Aditya, K and Kumar, S (2018). Small-area estimation under a log-transformed area-level model. *Journal of Statistical Theory and Practice* 12(3): 497-505.
6. Chandra, H, Kumar, S and Aditya, K (2018). Small area estimation of proportions with different levels of auxiliary data. *Biometrical Journal* 60*: 395-415.*
7. Das, K, Choudhary, AK, Pooniya, V, Swarnalakshmi, K, Parihar, CM, Bana, RS and Sarkar, SK (2017). Integrated crop management modules for enhancing productivity and profitability of direct-seeded basmati rice (*Oryza sativa). Indian Journal of Agronomy* 62 (4): 528–530.
8. Das, S, Rai, A, Mishra, DC and Rai, SN (2018). Statistical Approach for Gene Set Analysis with Trait Specific Quantitative Trait Loci. *Nature Scientific Reports* 8: 2391 *DOI:10.1038/s41598-018-19736-w*.
9. Das, S, Rai, A, Mishra, DC and Rai, SN (2018). Statistical Approach for Selection of Biologically Informative Genes. *Gene https://doi.org/10.1016/j.gene.2018.02.044*

10. Jaiswal, S, Antala, TJ, Kheni, Jk, Chopra, M, Mandavia, MK, Tomar, RS, Jasrotia, RS, Iquebal, MA, Angadi, UB, Rai, A and Kumar, D (2017) Transcriptomic signature of drought response in pearl millet (Pennisetum glaucum (L.) and development of web-genomic resources. *Nature Scientific Reports* https://www.nature.com/articles/s41598-018-21560-1.
11. Jangam, AK, Bhuvaneswari, T, Krishnan, AN, Katneni, VK, Avunje, S, Grover, M, Kumar, S, Alavandi, SV, Vijayan, KK (2018). Draft genome sequence of Vibrio parahaemolyticus strain VP14, isolated from a Penaeus vannamei culture farm. *Genome Announc* 6: 149-158. *https://doi.org/10.1128/genomeA.00149-18*.
12. Jha, UC, Jha, R, Bohra, A, Parida, SK, Kole, PC, Thakro, V, Singh, D and Singh, NP (2018). Population structure and association analysis of heat stress relevant traits in chickpea (Cicer arietinum L.). *Biotech* 8(43): *doi.:10.1007/s13205-017-1057-2*.
13. Junaid, A, Kumar, H, Rao, AR, Patil, AN, Singh, NK and Gaikwad, K (2018). Unravelling the epigenomic interactions between parental inbreds resulting in an altered hybrid methylome in Pigeonpea. *DNA Research*, *doi: 10.1093/dnares/dsy008*.
14. Kumar, P, Lal, K, Mukherjee, A, Pradhan, UK, Ray, M and Prakash, O (2018). Advanced Row-Column Designs for Animal feed Experiments. *The Indian Journal of Animal Sciences* 88 (4): 499-503.
15. Lall, S, Jaggi, S, Varghese, E, Varghese, C and Bhowmik, A (2018). An algorithmic approach to construct D-optimal saturated designs for logistic model. *Journal of Statistical Computation and Simulation* 88(6): 1191-1199.
16. Mahalingaraya, Rathod, S, Sinha K, Shekhawat, RS and Chavan, S (2018). Statistical Modeling and Forecasting of Total Fish Production of India: A Time Series Perspective. *Int. J. Curr. Microbiol. App. Sci* 7(3): 1698-1707.
17. Maragal, SY, Singh, AK, Behera, TK, Munshi, AD and Dash, S (2018). Effect of planting time and fertilizer dose on growth, yield and quality of parthenocarpic cucumber (Cucumis sativus) grown under polyhouse and nethouse conditions. *Indian Journal of Agricultural Sciences* 88 (1): 63–69.
18. Maragal, SY, Singh, AK, Behera, TK, Munshi, AD and Dash, S (2018). Effect of planting time and fertilizer dose on growth, yield and quality of parthenocarpic cucumber (Cucumis sativus) grown under polyhouse and nethouse conditions, *Indian Journal of Agricultural Sciences* 88 (1): 63–69.
19. Meher, PK, Sahu, T., Gahoi, S and Rao, AR (2017). ir-HSP: Improved recognition of heat shock proteins, their families and sub-types based on g-spaced di-peptide features and support vector machine. *Frontiers in Genetics: Bioinformatics and Computational Biology* 8**:** 235. *doi: 10.3389/fgene.2017.00235*.
20. Meher, PK, Sahu, TK, Gahoi, S and Rao, AR (2018). ir-HSP: Improved recognition of heat shock proteins, their families and sub-types based on g-spaced di-peptide features and support vector machine. *Frontiers in Genetics* 8: 235(1-17).

21. Mitra, D, Paul, RK and Paul, AK (2017). Statistical modelling for forecasting volatility in potato prices using ARFIMA-FIGARCH model. *Indian Journal of Agricultural Sciences* 88 (2), 268–272.
22. Mitra, D, Paul, RK, Kumar, A and Panwar, S (2017). Multivariate time series model for forecasting Urad price in different zones of India. *Indian Journal of Agricultural Marketing* 31 (3): 36-41.
23. Parui, S, Parsad, R and Mandal, BN (2018). A-optimal completely randomized designs for incomplete factorial structures with three factors. *Statistics and Probability Letters* 137: 343-348.
24. Qureshi, NW, Krishnan, M, Wani, SA, Ramasubramanian, V, Sivaramane, N and Sundaramoorthy, C (2017). Negative Externalities in Kashmir Lake Fisheries: Transformation in Species Patronage, Use Priorities and Policy. *Indian Journal of Agricultural Economics* 72(1): 89-101.
25. Rathod, S, Singh, KN, Patil, SG, Naik, RH, Ray, M and Meena, VS (2018). Modeling and forecasting of oilseed production of India through artificial intelligence techniques. *Indian Journal of Agricultural Science* 88 (1): 22-27.
26. Salas, S, Ojha, SN, Ramasubramanian, V, Vipin kumar,VP and Ananthan PS (2017). Entrepreneurship based empowerment among fisherwomen self help groups of Kerala. *Indian Journal of Fisheries* 64(4): 106-111.
27. Sarkar, S, Padaria, RN and Bhowmik, A (2017). Analyzing farmers' vulnerability and adaptation strategy to climate change in arid ecosystem of India. Range management and Agroforestry 38(1): 127-133.
28. Sharma, L, Dalal, M, Verma, RK, Kumar, SVV, Yadav, SK, Pushkar, S, Kushwaha, SR, Bhowmik, A and Chinnusamy, V (2018). Auxin protects spikelet fertility and grain yield under drought and heat stresses in rice. *Environmental and Experimental Botany* 150: 9–24.
29. Shekhawat, RS, Singh, KN, Arya P, Choudhary, BB and Rathod, S (2017). Production Performance, Instability and Decomposition Analysis of Pulses in Rajasthan. *Bulletin of Environment, Pharmacology and Life Sciences* 6(5): 368-371.
30. Sinha, K, Panwar, S, Alam, W, Singh, KN, Gurung, B, Paul, RK and Mukherjee, A (2018). Price volatility spillover of Indian onion markets: A comparative Study. *Indian Journal of Agricultural Sciences* 88(1):114-120.
31. Vinay, A, Ramasubramanian, V, Krishnan, M and Ananthan, PS (2018). Total factor productivity of Tuna fisheries in Lakshadweep, *Indian Journal of Geomarine Sciences* 47(2): 319-322.

Popular Articles

- Arpan Bhowmik, Seema Jaggi, Eldho Varghese, Cini Varghese, Anindita Datta and Mohd. Harun. (2018). SAS Macro for the generation of a class of strongly neighbour balanced block

design. https://www.biotecharticles.com/Agriculture-Article/SAS-Macro-for-the-Generation -of-a-Class-of-Strongly-Neighbour-Balanced-Block-Designs-4339.html

Reference Manual / Manual/ E-manual/ Pamphlet etc.

- Singh, K.N. and Kumar, R.R. (2018). Recent Developments in Statistical Modeling and Forecasting in Agriculture**.** Reference Manual (Vol I and Vol II) Published for Training under CAFT during 28 December, 2017 to 17 January, 2018,ICAR-IASRI, New Delhi Publication.
- Singh, K.N. and Kumar, R.R. (2018). Recent Developments in Statistical Modeling and Forecasting in Agriculture**.** Published E-manual (CD) for Training under CAFT during 28 December, 2017 to 17 January, 2018.
- Iquebal, M. A., Sarika, Angadi, U.B., Kumar D. and Anil Rai (2018). E-Publication on Root drought transcriptome of Wheat crop. NCBI Bioproject: PRJNA432496; BioSamples: SAMN08450194, SAMN08450195, SAMN08450196, SAMN08450197 (Collaborative work of ICAR-IASRI, New Delhi and ICAR-IIWBR, Karnal under CABin Scheme Project).
- Sarika, Iquebal, M. A., Kumar D. and Anil Rai (2018). E-Publication on Root drought transcriptome of Pearl Millet crop. NCBI Bioproject: PRJNA385901 Biosamples: SAMN06920424, SAMN06920426, SAMN06920432, SAMN06920433 SRA accession number: SRR5839373, SRR5839374, SRR5839375, SRR5839376 (Collaborative work of ICAR-IASRI and Junagadh Agricultural University, Junagadh).
- Sarika, Iquebal, M.A., Kaur, M., Rai, A., and Kumar, D. (2018). Application of OMICS Tools and Techniques for Agricultural Germplasm Improvement. Published E-Reference Manual (CD) for training under CAFT from 9th February to 1th March, 2018.
- Sarika, Iquebal, M.A., Kaur, M., Rai, A., and Kumar, D. (2018). Application of OMICS Tools and Techniques for Agricultural Germplasm Improvement. Reference Manual Vol. I and Vol. II , published for Training under CAFT during 9th February, 2018 to 1th March, 2018, ICAR-IASRI, New Delhi Publication.
- Jaggi, S. and Datta, A. (2018). Statistical Advances for Agricultural Data Analysis. Reference Manual Vol. I. and Vol. II Published of Training under CAFT during March 3-23, 2018, ICAR-IASRI, New Delhi Publication.
- Jaggi S. and Datta, A. (2018). Statistical Advances for Agricultural Data Analysis. E-Manual Published of Training under CAFT during March 3-23, 2018.
- Marwaha, S., Arora, A., Bharadwaj, A., Dahiya, S., Singh, P., Grover, R., Maurya, M.M. (2018). Education Portal Pamphlet**.** Published and Launched by Hon'ble Union Minister of Agriculture and Farmer Welfare on March 08, 2018 during Director Conference at NASC Complex, New Delhi.

Book Chapters Published

- Dahiya, S. and Bharadwaj, A (2018). Educational Data Mining in Agriculture. *In Proceedings of the 12th INDIACom; IEEE Conference ID: 42835 2018 5th International Conference on "Computing for Sustainable Global Development",* 14 – 16 March, 2018. ISSN 0973-7529; ISBN 978-93-80544-28-1, 2291-2294
- Saravanakumar, R., Jain, R., Arora, A. and Marwaha, S. (2018). Automated approach to apportion time series data for dynamic district boundaries. In Proceedings of the 12th INDIACom; INDIACom-2018; IEEE Conference ID: 42835 2018 5th International Conference on "Computing for Sustainable Global Development", 14 – 16 March, 2018 Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi (INDIA), ISSN 0973-7529; ISBN 978-93-80544-28-1.
- Deb, C.K., Marwaha, S., Jain, R., Arora, A., Das, M (2018) Connective based taxonomy extraction from specialized text for Ontology Learning. in Agriculture. Proceedings of the 12th INDIACom; INDIACom-2018; IEEE Conference ID: 42835 2018 5th International Conference on "Computing for Sustainable Global Development", 14th – 16th March, 2018 Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi (INDIA), ISSN 0973-7529; ISBN 978-93-80544-28-1.

Statistical and Geographic Information System/ Data bases/mobile apps developed.

1. Anirban Mukherjee, Premlata Singh, Tanuj Mishra, Satyapriya, Mrinmoy Ray, Arpan Bhowmik and Rajarshi Roy Burman
   - 5-Dimensional Managerial Competency Battery (5D-MCB). Available at http://5dmcb.iari.res.in/5D_MCB/intro.jsp.

2. M.A. Iquebal, Sarika, Anil Rai and Dinesh Kumar:
   - Developed an online web genomic resource, BanSatDB (http://webtom.cabgrid.res.in/bansatdb/) having the highest number (> 341,000) of putative STR markers from *Musa genera* so far, represented by three species: *M. acuminata* (110,000), *M. balbisiana* (107,000), and *M. itinerans* (124,000) from 11 chromosomes of each species. BanSatDB has also been populated with 580 validated STR markers from the published literature

3. Sudeep Marwaha, Mukesh Kumar and Pal Singh:
   - Mobile Apps (Animal Reproduction and Pig Farming) were launched by Hon'ble Union Minister of Agriculture and Farmer Welfare on 08 March, 2018 during Director's Conference at NASC Complex, New Delhi.

4. Sudeep Marwaha, Alka Arora, Anshu Bharadwaj, Shashi Dahiya and Pal Singh
   - Education Portal (http://education.icar.gov.in) was launched by Hon'ble Union Minister of Agriculture and Farmer Welfare on 08 March, 2018 during Director Conference at NASC Complex, New Delhi.

5. U.B.Angadi:

- Mobile app "FeedGuide" made available in Google Playstore for downloading the apps. As on date 31 March 2018, total 75 "FeedGuide" app installations in India. The app "FeedGuide" poster is presented in "Krishi Unnathi Mela 2018 at IARI, Pusa New Delhi. The app "FeedGuide" is demonstrated in "Krushi Odisha 2018" on 6th to 9th March 2018 at Bhubaneswar, Odisha.

Package Developed

1. Dr. Anirban Mukherjee, Dr. Premlata Singh, Dr. Tanuj Mishra, Dr. Satyapriya, Dr. Mrinmoy Ray, Dr. Arpan Bhowmik and Dr. Rajarshi Roy Burman.

- 5-Dimensional Managerial Competency Battery (5D-MCB). Available at http://5dmcb.iari.res.in/5D_MCB/intro.jsp. Statistical and Geographic Information System/ Data bases/mobile apps developed.

2. Dr. U.B. Angadi, Dr. M.A. Iquebal, Dr. Sarika, Dr. Anil Rai and Dr. Dinesh Kumar.

- Developed software for Variety Identification System for Triticum aestivum (Wheat).
- Developed Wheat Drought Transcriptome Database.

3. Dr. U.B. Angadi, Dr. M.A. Iquebal, Dr. Sarika, Dr. Anil Rai and Dr. Dinesh Kumar.

- Completed mobile app development of Variety Identification System for *Triticum aestivum* (Wheat)

4. Dr. M.A. Iquebal, Dr. Sarika, Dr. Anil Rai and Dr. Dinesh Kumar.

- Developed an online web genomic resource, BanSatDB (http://webtom.cabgrid.res.in/bansatdb/) having the highest number (> 341,000) of putative STR markers from Musa genera so far, represented by three species: M. acuminata (110,000), M. balbisiana (107,000), and M. itinerans (124,000) from 11 chromosomes of each species. BanSatDB has also been populated with 580 validated STR markers from the published literature.

5. Dr. U. B. Angadi.

- Refinement of mobile app "FeedAssist" Incorporate suggestion by ILRI Animal Nutrition scientist and added Oriya language

6. Dr. Sudeep Marwaha, Dr. Mukesh Kumar and Pal Singh.

- Mobile Apps (Animal Reproduction and Pig Farming) were launched by Hon'ble Union Minister of Agriculture and Farmer Welfare on March 08, 2018 during Director Conference at NASC Complex, New Delhi.

7. Dr. Sudeep Marwaha, Dr. Alka Arora and Dr. Anshu Bharadwaj.

- Education Portal (http://education.icar.gov.in) was launched by Hon'ble Union Minister of Agriculture and Farmer Welfare on March 08, 2018 during Director Conference at NASC Complex, New Delhi.

8. Dr.U.B.Angadi.

- Mobile app "FeedGuide" made available in google pay store for downloading the apps. As on date 31 March 2018 total 75 "FeedGuide" app installation in India. The app "FeedGuide" poster is presented in "Krishi Unnathi Mela 2018 at IARI, Pusa New Delhi. The app "FeedGuide" is demonstrated in "Krushi Odisha 2018" on 6th to 9th March 2018 at Bhubaneswar, Odisha. Refinement of mobile app "FeedGuide" and uploaded into google play store.

9. Dr. U.B. Angadi, Dr. M.A. Iquebal, Dr. Sarika, Dr. Anil Rai and Dr. Dinesh Kumar.

- In the web portal "Fungsatdb", primer3 issue rectified and competed FungsatDB portal and ready for publication "Rohu Fish Genome Browser" using GBrowser tool and incorporated all scaffolds and contiges with markers.

LECTURES DELIVERED

Rajeev Ranjan Kumar

- Descriptive Statistics using MS Excel in Centre of Advanced Faculty Training (CAFT) programme on "Quantitative Methods for Agricultural Policy Analysis" at ICAR-IARI, New Delhi during 23 January, 2018 to 12 February, 2018.

Ravindra Singh Shekhawat

- Panel Data Regression and Heteroscedasticity in data in CAFT at ICAR-IARI, New Delh, on 10 January, 2018.

Ramasubramanian V.

- An Overview of SPSS with hands-on session in training programme on Quantitative Methods for Agricultural Policy Analysis held at ICAR-IARI, New Delhi during 23 January, 2018 to 12 February, 2018.

Dinesh Kumar

- Gene finding strategies and their validation in silico in CAFT programme on Whole genome sequencing of plant pathogens: Methods and Applications at IARI, New Delhi on 13 January, 2018.

Hukum Chandra

- (Small Area Estimation Techniques and Use of Small Area Estimation in Agricultural Statistics) in the two week training progrmamme on "Agriculture & Allied Statistics" for the ISS Probationers of 40th ISS Batch during 01-12 January, 2018 at the National Statistical Systems Training Academy, Ministry of Statistics & Programme Implementation, Greater Noida on 11 January, 2018.

Tauqueer Ahmad

- Horticulture Statistics at the NSSTA, in a training programme for ISS probationers, Greater Noida on 25 January, 2018.

Rajender Parsad

- Application of SAS for Survey Data Analysis to the participants of the training programme organized under the aegis of CAFT at Division of Agricultural Economics, ICAR-IARI, New Delhi during January 23 to February 12, 2018 on 03 February, 2018.
- "Significance of Statistics and Web Resources" to the B.Sc. (Statistics) students of Kirori Mal College of Delhi University, Delhi on 20 February, 2018.
- Significance of Experimental Designs to the participants of Annual Inter college Statistics Fest Random Walk organized during February 26-27, 2018 at Ram Lal Anand College of Delhi University, Delhi on 26 February, 2018.

M. A. Iquebal

- Application of computational genomics in agriculture during Winter School on "Molecular Breeding for higher productivity, quality, food colorants, nutraceutical and bioactive health compounds in vegetable crops" at Division of Vegetable Science, Indian Agricultural Research Institute, New Delhi on 26 February, 2018.

D.C. Mishra

- Machine Learning Techniques using R, Multivariate Techniques using R and Mixed Effect Modeling using R in the training entitled "Advanced Statistical Methods using R" held at Indian Council of Forestry Research and Education (ICFRE), Dehradun, Uttrakhand during 19-23, February, 2018.
- "Machine Learning Techniques using R", "Multivariate Techniques using R" in the training entitled "National Workshop on Statistical Techniques and Data Analysis using R" held at Central University of Haryana, Mahendragarh, during 19-23, March, 2018.

K.K. Chaturvedi

- Basics of R, Ways of Data Handling in R and Control Statement of R at Indian Council of Forestry Research and Education (ICFRE) Dehradun in the workshop during 19-20 February, 2018.

Sanjeev Kumar

- Genome Annotation" in a workshop on In Silico Prediction of Genes and Their Functional Characterization through Protein Modelling" at Dept. of Genetics and Plant Breeding, Ch. Charan Singh University, Meerut on 12 March, 2018.

Hukum Chandra

- Statistical Techniques and Data Analysis using R at Central University of Haryana, Mahendragarh, Haryana on 21 March, 2018.

A.R. Rao

- Presented an Invited talk on Translational Bioinformatics in 29th BTISnet Coordinators meeting held during 03-05 February 2018 by DBT, Government of India, at Manonmaniam Sundaranar university, Tirunelveli, Tamilnadu

Invited Lectures Delivered

1. Delivered a lecture on "Descriptive Statistics using MS Excel" in Centre of Advanced Faculty Training (CAFT) programme on "Quantitative Methods for Agricultural Policy Analysis" during 23rd January 2018 to 12th February 2018 at ICAR-IARI, New Delhi.(Mr. Rajeev Ranjan Kumar)
2. Delivered a lecture on Panel Data Regression and Heteroscedasticity in data in CAFT on 10th January, 2018 at ICAR-IARI, New Delhi. (Dr. RavinDr.a Singh Shekhawat)
3. Delivered two lectures in the ICAR Sponsored CAFT programme on "Quantitative Methods for Agricultural Policy Analysis" held during 23rd January 2018 to 12th February 2018 at ICAR-IARI, New Delhi on the topic "An Overview of SPSS with hands-on session". (Dr. Ramasubramanian V.)
4. Delivered Invited lecture on "Gene finding strategies and their validation in silico" in CAFT programme on Whole genome sequencing of plant pathogens: Methods and Applications on January 13, 2018 at IARI, New Delhi. (Dr. Dinesh Kumar)
5. Delivered two lectures (Small Area Estimation Techniques and Use of Small Area Estimation in Agricultural Statistics) in the two week training progrmamme on "Agriculture & Allied Statistics" for the ISS Probationers of 40th ISS Batch during 01-12 January, 2018 at the National Statistical Systems Training Academy, Ministry of Statistics & Programme Implementation, Greater Noida on 11 January, 2018. (Dr. Hukum ChanDr.a)
6. Dr. Tauqueer Ahmad delivered two lectures on "Horticulture Statistics" at the NSSTA, Greater Noida on 25 January, 2018 in a training programme for ISS probationers.
7. Delivered an invited talk on Application of SAS for Survey Data Analysis to the participants of the training programme organized under the aegis of CAFT at Division of Agricultural Economics, ICAR-IARI, New Delhi during January 23 to February 12, 2018. (The lecture was delivered on February 03, 2018).(Rajender Parsad)

8. Delivered an invited talk on Significance of Statistics and Web Resources to the B.Sc. (Statistics) students of Kirori Mal College of Delhi University, Delhi on February 20, 2018. (Rajender Parsad)
9. Delivered an invited talk on Significance of Experimental Designs to the participants of Annual Inter college Statistics Fest Random Walk organized during February 26-27, 2018 at Ram Lal Anand College of Delhi University, Delhi. (The lecture was delivered on February 26, 2018). (Rajender Parsad)
10. Delivered invited lecture on "Application of computational genomics in agriculture" during Winter School on "Molecular Breeding for higher productivity, quality, food colorants, nutraceutical and bioactive health compounds in vegetable crops" at Division of Vegetable Science, Indian Agricultural Research Institute, New Delhi on February 26, 2018. (Dr. M. A. Iquebal)
11. Delivered three lectures on the topics "Machine Learning Techniques using R", "Multivariate Techniques using R" and "Mixed Effect Modeling using R" in the training entitled "Advanced Statistical Methods using R" during 19-23, February, 2018 held at Indian Council of Forestry Research and Education, Dehradun, Uttrakhand. (Dr. D.C. Mishra)
12. Delivered three invited lectures entitled “Basics of R”, ”Ways of Data Handling in R” and “Control Statement of R” at ICFRE Dehradun in the workshop during 19-20 Feb 2018. (Dr. K.K. Chaturvedi)
13. Delivered two lectures on the topics "Machine Learning Techniques using R", "Multivariate Techniques using R" in the training entitled "National Workshop on Statistical Techniques and Data Analysis using R" during 19-23, March, 2018 held at Central University of Haryana, Haryana.(Dr. D.C. Mishra)
14. Delivered lectures for 2 whole days on fundamentals of design of experiments, Basic Statics, Multivariate analysis and Statistical genomics to 21 faculty of BASU and also students of UG 2nd year and PG of BASU, Patna in the three day workshop on “Basic Statistical Computing procedures for analysis of experimental data”.(Dr. Sukanta Dash)
15. Delivered an invited lecture and conducted a handson training session on “Genome Annotation” in a workshop on “In Silico Prediction of Genes and Their Functional Characterization through Protein Modelling” at Dept. of Genetics and Plant Breeding, Ch. Charan Singh University, Meerut on 12th March 2018. (Dr. Sanjeev Kumar)
16. Delivered two lectures in the National workshop on "Statistical Techniques and Data Analysis using R" at Central University of Haryana, Mahendergarh, Haryana on 21 March, 2018.(Dr. Hukum Chandra)

Papers Presented in Conferences

1. Dr. P.K. Meher presented a paper entitled “Computational identification and categorization of nitrogen fixation proteins of diaztrophs using support vector machine” in an international symposium titled "Emerging Areas in Biosciences and Biomedical Technologies (eBBT) 2018", which was organised during 05-06 January, 2018, at IIT Indore, Madhya Pradesh.
2. Dr. R.K. Paul presented the invited paper “Wavelet based forecasting models and their applications” in the international conference on Changing Paradigms and Emerging

Challenges in statistical sciences (PECS-2018) of Society of Statistics, Computer and Applications (SSCA) during 29-31 January, 2018 at Pondicherry University, Puducherry.

3. Dr. Rajender Parsad, Dr. A. Dhandapani, Dr. G.P. Obi Reddy, Dr. V.K. Sehgal, Dr. Mukesh Kumar, Dr. Anshu Dixit and Dr. A.K. Choubey. ICAR Research Data Repository for Knowledge Management. (Invited Talk in Session on Information and Knowledge Management Systems in the International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences (20th Annual Conference of Society of Statistics, Computer and Applications) organized at Department of Statistics, Pondicherry University, Puducherry during January 29-31, 2018).
4. Dr. BN Mandal, Dr. Rajender Parsad and Dr. Sukanta Dash. (2018). Algorithmic construction of weighted A-optimal balanced treatment incomplete block designs (Invited talk in the session on "Design of Experiments" in the International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences (20th Annual Conference of Society of Statistics, Computer and Applications) organized at Department of Statistics, Pondicherry University, Puducherry during January 29-31, 2018).
5. Mohd. Harun, Dr. Cini Varghese, Dr. Seema Jaggi, Dr. Eldho Varghese and Dr. Anindita Datta (2018). PTC for Comparing Test-lines with Single Control-line. (Contributed Talk in the International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences (20th Annual Conference of Society of Statistics, Computer and Applications) organized at Department of Statistics, Pondicherry University, Puducherry during January 29-31, 2018).
6. Dr. Anindita Datta, Dr. Seema Jaggi, Dr. Cini Varghese, Dr. Eldho Varghese and Mohd. Harun (2018). Generalized row-column designs: construction and web generation. (Contributed Talk in the International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences (20th Annual Conference of Society of Statistics, Computer and Applications) organized at Department of Statistics, Pondicherry University, Puducherry during January 29-31, 2018).
7. Dr. Sukanta Dash, Dr. B N Mandal, and Dr. Rajender Parsad (2018). Orthogonal and Nearly Orthogonal space filling Latin Hypercube Designs. Contributed Talk in the International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences (20th Annual Conference of Society of Statistics, Computer and Applications) organized at Department of Statistics, Pondicherry University, Puducherry during January 29-31, 2018).
8. Dr. Mukesh Kumar, Dr. Soumen Pal and Dr. Sudeep Marwaha, "Mobile App: An effective ICT tool for Agricultural Knowledge Dissemination",presented in International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences in conjunction with Bi-Decennial Convention of Society of Statistics, Computer and Applications during January 29-31, 2018 at Pondicherry University, Puduchery.

9. Dr. Shashi Dahiya presented a contributory paper on "Status of eLearning in Agriculture" in International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences in conjunction with Bi-Decennial Convention of Society of Statistics, Computer and Applications during January 29-31, 2018 at Pondicherry University, Puduchery.
10. Dr. Soumen presented the following contributory paper: “Knowledge Dissemination and Farmers’ Query Resolution through KVK Portal and KVK Mobile App” jointly written by Soumen Pal, Sudeep Marwaha, Alka Arora, A. K. Choubey, P. Adhiguru and Randhir Singh in International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences in conjunction with Bi-Decennial Convention of Society of Statistics, Computer and Applications during January 29-31, 2018 at Pondicherry University, Puduchery.
11. Dr. Shashi Dahiya delivered an Invited talk on "A software module for ensemble of Feature Selection Techniques" in the Invited Paper Session on "Information and Knowledge Management" held on 30th of January'18 in International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences(IPECS-2018) in conjunction with Bi-Decennial Convention of Society of Statistics, Computer and Applications during January 29-31, 2018 at Pondicherry University, Puduchery.
12. Dr. M. A. Iquebal presented research paper entitled "Deciphering pathogenicity related genes of groundnut stem rot causing fungus Sclerotium rolfsii by whole genome sequencing" by Dr. MA Iquebal, Dr. Rukam S Tomar, Dr. MV Parakhia, Dr. Deepak Singla, Dr. Sarika Jaiswal, Dr. VM Rathod, Dr. SM Padiyar, Dr. Neeraj Kumar, Dr. Anil Rai, Dr. Dinesh Kumar in International Conference on Emerging Trends in Biomaterial, Bioscience, Bioinformatics, Biomedical Engineering, Cancer Biology, Stem Cell Research, Cell Apoptosis and Applied biotechnology (BCS-2018) on January 18, 2018 at Jawaharlal Nehru University,
13. Dr. D.C. Mishra presented an invited talk on "Genomic Prediction: A Way Forward to Molecular Breeding" in a technical session entitled "Statistical Genomics" in International Conference on Changing Paradigms and Emerging Challenges in Statistical Science organised by Society of Statistics, Computer and Application during 29-31, January, 2018 held at Pondicherry University, Pondicherry, India.
14. Dr. S.B. Lal presented an invited talk on “Computational Issues of Genome Assembly” in the session “Information and Knowledge Management” held during 16:00 to 18:00 PM on 30th January, 2018 in International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences (IPECS-2018) of Society of Statistics, Computer and Applications (SSCA) held during 29-31 January, 2018 at Department of Statistics, Pondicherry University, R.V. Nagar, Kalapet, Puducherry-605 014, INDIA.
15. Dr. U.B. Angadi presented an oral presentation at South-south cooperation: India-Africa partnership for food security and capacity building conference at University of Mumbai, Mumbai, Maharashtra on 23rd and 24th Jan 2018.

16. Dr. Hukam Chandra, presented a paper entitled “Small Area Prediction of Survey Weighted Counts” in International Conference on Theory and Applications of Statistics and Information Sciences held at Coimbatore, Tamil Nadu during 05 - 07 January, 2018.
17. Dr. Hukam Chandra presented a paper entitled “The use of sampling weights in small area estimation of proportions under area level model” in International Conference on “Changing Paradigms at Emerging Challenges in Statistical Sciences” in conjunction with the Bi-Decennial Conference of the Society of Statistics, Computer and Applications held at Pondicherry University, Puducherry during 29-31 January, 2018.
18. Dr. Kaustav Aditya and Dr. Hukum Chandra (2018). “Estimation of Yield of Major Crops at District Level Based on Reduced Sample Sizes” presented in International Conference on Changing Paradigms at Emerging Challenges in Statistical Sciences in conjunction with the Bi-Decennial Conference of the Society of Statistics, Computer and Applications held at Pondicherry University, Puducherry during 29-31 January, 2018.
19. Dr. Arpan Bhowmik, Dr. E. Varghese, Dr. Seema Jaggi, Dr. Cini Varghese and Dr. S. Lall “Computational Tools for Generation of Cost-effective Run Orders Useful for Agricultural and Industrial Research” paper presented by the first author in III LACSC: LATIN AMERICAN CONFERENCE ON STATISTICAL COMPUTING held from 27-02-2018 to 02-03-2018 at University of Costa Rica, SAN JOSÉ,COSTA RICA
20. Dr. Cini Varghese. (2018). Some series of partially balanced incomplete block designs [Invited talk on 15.02.2018 in the “National Conference for Women in Statistics and Analytics” organized by Department of Statistics, Savitribai Phule Pune University, Pune during February 14-16, 2018..
21. Dr. Seema Jaggi. (2018). Generalized Row-Column Designs [Invited talk delivered on 15.02.2018 in the “National Conference for Women in Statistics and Analytics” organized by Department of Statistics, Savitribai Phule Pune University, Pune during February 14-16, 2018.
22. Dr. Sukant Dash. (2018). Orthogonal and Nearly Orthogonal space filling Latin Hypercube Designs [Contributed talk on 30th January, 2018 in the International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences (IPECS-2018) (29 - 31 January 2018) in Conjunction with Bi-Decennial Conference of Society of Statistics, Computer and Applications (SSCA) Organized by Department of Statistics, Pondicherry University, Puducherry.
23. Dr. Hukum Chandra. (2018). Small Area Estimation of Poverty and Social Exclusion Indicators. National Seminar on "Recent Advance in Statistics for Industries and Corporates" at Department of Statistics, Anand, Gujarat during 10-11 February, 2018 (invited talk)
24. Dr. Sarika presented research paper entitled "TaSSRDb: The putative microsatellite DNA marker-based wheat genomic resource for germplasm management" authored by Sarika

Jaiswal, Sonia Sheoran, Vasu Arora, Ulavappa B. Angadi, Mir Asif Iquebal, Nishu Raghav, Bharti Aneja, Deepender Kumar, Rajender Singh, Pradeep Sharma, G.P. Singh, Anil Rai, Ratan Tiwari and Dinesh Kumar in the "International Conference on Recent Trends in Agriculture, Food Science, Forestry, Horticulture, Aquaculture, Animal Sciences, Biodiversity, Ecological Sciences and Climate Change (AFHABEC-2018)" held at Jawaharlal Nehru University,New Delhi on 10th February, 2018.

25. Dr. Neeraj Budhlakoti presented a paper entitled “SNPRBb: Trait specific SNP Database of *Bubalus bubalis*” in IX Asian Buffalo congress, ABC-2018 held at CIRB, Hisar from February 01 to February 04, 2018.
26. ChanDr.a, H (2018). Small Area Estimation in Health Sector by Combining Demographic Health Survey and Census Data. International Symposium on Health Analytics and Disease Modeling, New Delhi, India during 08-09 March, 2018 (invited talk).
27. Dr. PK Meher presented a paper “Computational prediction of eukaryotic gene structures: probabilistic and machine learning methods” in national seminar on Recent trends in microbiology and biotechnology (RTMB-2018) organized by Department of biotechnology, during 16-17 March, 2018 at MITS School of biotechnology, Bhubaneswar, ODISHA.
28. Dr. Alka Arora presented a paper entitled “Automated approach to apportion time series data for dynamic district boundaries” authored by Saravanakumar R, Rajni Jain, Alka Arora, Sudeep Marwaha,in International Conference on Computing for Sustainable Global Development INDIACom-2018
29. Dr. Sudeep Marwaha presented a paper entitled “Connective based taxonomy extraction from specialized text for Ontology Learning in Agriculture” authored by Chandan Kumar Deb, Sudeep Marwaha, Rajni Jain, Alka Arora, Madhurima Das, in International Conference on Computing for Sustainable Global Development INDIACom-2018
30. Dr. Shashi Dahiya presented a contributory paper entitled "Educational Data Mining in Agriculture" authored by Dr. Shashi Dahiya and Dr. Anshu Bharadwaj in the INDIACom - 2018.
31. Dr. Anshu Bharadwaj presented a contributory paper entitled "Educational Data Mining in Agriculture" authored by Dr. Shashi Dahiya and Dr. Anshu Bharadwaj in the INDIACom - 2018.

PARTICIPATION

Participation in Conference/ Workshop/ Seminar/ Symposia/ Training/ Foundation Course/ Annual Day/ Lectures etc.

1. Anshu Bharadwaj participated in International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences (IPECS-2018) in conjunction with Bi-Decennial Convention of Society of Statistics, Computer and Applications during 29-31 January, 2018 at Pondicherry University, Puduchery.

2. Tauqueer Ahmad participated in one day workshop on "Pradhan Mantri Fasal Bima Yojna" held at Jaipur, Rajasthan on 28 January, 2018 organized jointly by Credit and Cooperation Division, Department of Agriculture, Cooperation & Farmers Welfare (DACFW), Ministry of Agriculture & Farmers Welfare (MoAFW), Govt. of India and ICICI Lombard GIC Limited.
3. Dinesh Kumar attended International Symposium on Biodiversity and Biobanking (BIODIVERSE 2018) at Guwahati, during 27-29 January, 2018 jointly organized by Indian Institute of Technology, Guwahati in association with Association for Promotion of DNA Fingerprinting and Other DNA Technologies (ADNAT).
4. Neeraj Budhlakoti attended International Conference IX Asian Buffalo Congress, ABC-2018 held at ICAR-CIRB, Hisar during 01-04 February, 2018.
5. Sudeep Marwaha, Alka Arora, Anshu Bharadwaj and Shashi Dahiya attended the 5th International Conference on Computing for Sustainable Global Development (INDIACom - 2018) technically sponsored by IEEE Delhi Section, held during 14 – 16 March, 2018 at Bharati Vidyapeeth Institute of Computer Applications and Management, New Delhi.
6. Ramasubramanian V. attended Policy cum Concluding Workshop on Technology Enhanced Learning in Agricultural Education- The Roadmap during 24-25 January, 2018 at ICAR-NAARM, Hyderabad.
7. Dinesh Kumar attended International Symposium on Biodiversity and Biobanking (BIODIVERSE 2018) at Guwahati, during 27-29 January, 2018 jointly organized by Indian Institute of Technology, Guwahati in association with Association for Promotion of DNA Fingerprinting and Other DNA Technologies (ADNAT).
8. All Scientists of IASRI attended Hindi workshop on "Statistics and Informatics for Farmer's Welfare" organized at ICAR-IASRI on 20 January, 2018.
9. Susheel Kumar Sarkar attended a National Seminar on Challenges of Agricultural Policy Reforms organized by Centre for Agricultural Policy Dialogue and Techno-Economic Research Institute, New Delhi, at India International Center, New Delhi on 05 January, 2018.
10. Ranjit Kumar Paul attended the Review workshop of NICRA during 12-13 February, 2018 at NASC complex, New Delhi.
11. Seema Jaggi and Cini Varghese attended the National Conference for Women in Statistics and Analytics organized by Department of Statistics, Savitribai Phule Pune University, Pune during 14-16, February, 2018.
12. Ramasubramanian V. attended a one day theme event entitled “Future of life on Earth – Role of disruptive technologies” conducted by TIFAC, New Delhi at IIT, Delhi as part of TIFAC’s 31st Foundation day on 10 February, 2018.
13. Mukesh Kumar and Soumen Pal participated in the Annual Review Workshop of Farmer FIRST Programme held during 21-22 February, 2018 at our institute.
14. Hukum Chandra participated in the National Seminar on Recent Advance in Statistics for Industries and Corporates at Department of Statistics, Anand, Gujarat during 10-11 February, 2018.
15. Hukum Chandra participated in the Hindi workshop on *Rajbhasa Kriyavyan avam Podha Kism Adhiniyam 2001 avam Krishak Adhikar* at our institute on 13 February, 2018.

16. Hukum Chandra participated in National workshop on Statistical Techniques and Data Analysis using R at Central University of Haryana, Mahendergarh, Haryana on 21 March, 2018.
17. Cini Varghese attended three days workshop cum training programme under the National Agricultural Science Fund Project Creating a fully characterized genetic resource pipeline for mustard improvement during 07-09 March, 2018 at our institute
18. U.B. Angadi participated in Krishi Unnathi Mela 2018 at IARI, Pusa New Delhi for presentation of Mobile App - FeedGuide.
19. U.B. Angadi participated in Krushi Odisha 2018 during 06-09 March 2018 at Bhubaneswar, Odisha for demonstration of Mobile App - FeedGuide.
20. Harish Kumar HV completed three months professional attachment training from 04 December, 2017 to 03 March, 2018 at Department of Agricultural Economics, University of Agricultural Sciences, GKVK, Bengaluru, under the mentorship of Dr. B. V. Chinnappa Reddy.
21. Shashi Dahiya participated in International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences (IPECS-2018) in conjunction with Bi-Decennial Convention of Society of Statistics, Computer and Applications during 29-31 January, 2018 at Pondicherry University, Puduchery.

PAPER PRESENTED

- **National Conference for Women in Statistics and Analytics, Department of Statistics, Savitribai Phule Pune University, Pune, 14-16 February, 2018**
  - Cini Varghese, *Some series of partially balanced incomplete block designs*.
  - Seema Jaggi, *Generalized Row-Column Designs in the National Conference for Women in Statistics and Analytics*
- **International Conference on Theory and Applications of Statistics and Information Sciences, Coimbatore, Tamil Nadu during 05 - 07 January, 2018**
  - Hukum Chandra, *Small Area Prediction of Survey Weighted Counts*.
- **International Symposium on Health Analytics and Disease Modeling, New Delhi, India, 08-09 March, 2018.**
  - Hukum Chandra, *Small Area Estimation in Health Sector by Combining Demographic Health Survey and Census Data.*
- **National Seminar on "Recent Advance in Statistics for Industries and Corporates,.Department of Statistics, Anand, Gujarat 10-11 February, 2018.**
  - Hukum Chandra, *Small Area Estimation of Poverty and Social Exclusion Indicators*
- **International conference on "Changing Paradigms and Emerging Challenges in Statistical Sciences (PECS-2018)" (20th Annual Conference of Society of Statistics, Computer and Applications) Department of Statistics, Pondicherry University, Puducherry, 29-31 January, 2018.**

- R.K. Paul, *Wavelet based forecasting models and their applications.*
- Rajender Parsad*, A. Dhandapani, G.P. Obi Reddy, V.K. Sehgal, Mukesh Kumar, Anshu Dixit and A.K. Choubey, *Research Data Repository for Knowledge Management*.
- Hukam Chandra, *The use of sampling weights in small area estimation of proportions under area level model.*
- B.N Mandal*, Rajender Parsad and Sukanta Dash, *Algorithmic construction of weighted A-optimal balanced treatment incomplete block designs.*
- Mukesh Kumar*, Soumen Pal and Sudeep Marwaha, *Mobile App: An effective ICT tool for Agricultural Knowledge Dissemination.*
- Anshu Bharadwaj, *Spatial Data Analysis in a Geoportal: An Overview*.
- Shashi Dahiya, *A software module for ensemble of Feature Selection Techniques, Information and Knowledge Management.*
- D.C. Mishra, *Genomic Prediction: A Way Forward to Molecular Breeding, Statistical Genomics*.
- S.B. Lal, *Computational Issues of Genome Assembly, Information and Knowledge Management.*
- Kaustav Aditya* and Hukum Chandra, *Estimation of Yield of Major Crops at District Level Based on Reduced Sample Sizes*.

Contributary Papers Presented

- **International Conference on Emerging Trends in Biomaterial, Bioscience, Bioinformatics, Biomedical Engineering, Cancer Biology, Stem Cell Research, Cell Apoptosis and Applied biotechnology (BCS-2018) at Jawaharlal Nehru University. on January 18, 2018**
- M. A. Iquebal, Rukam S Tomar, MV Parakhia, Deepak Singla, Sarika Jaiswal, VM Rathod, SM Padiyar, Neeraj Kumar, Anil Rai, Dinesh Kumar, *Deciphering pathogenicity related genes of groundnut stem rot causing fungus Sclerotium rolfsii by whole genome sequencing* .**International Conference on Recent Trends in Agriculture, Food Science, Forestry, Horticulture, Aquaculture, Animal Sciences, Biodiversity, Ecological Sciences and Climate Change (AFHABEC-2018), held at Jawaharlal Nehru University, New Delhi on 10th February, 2018**
  - Sarika Jaiswal*, Sonia Sheoran, Vasu Arora, Ulavappa B. Angadi, Mir Asif Iquebal, Nishu Raghav, Bharti Aneja, Deepender Kumar, Rajender Singh, Pradeep Sharma, G.P. Singh, Anil Rai, Ratan Tiwari and Dinesh Kumar, *TaSSRDb: The putative microsatellite DNA marker-based wheat genomic resource for germplasm management.*
- **India-Africa partnership for food security and capacity building conference at University of Mumbai, Mumbai, Maharashtra on 23rd and 24th Jan 2018**

- U.B. Angadi*, Getachew Animut, S. Anandan, Michael Blümmel, Siboniso Moyo, Habibar Rahman and Chris Jones, *FeedBase-Ethiopia: Database and decision making tool for supply and demand of livestock feed resources in Ethiopia*

- **IIIrd LACSC: LATIN AMERICAN CONFERENCE ON STATISTICAL COMPUTING at University of Costa Rica, SAN JOSÉ,COSTA RICA held from 27-02-2018 to 02-03-2018**
  - Dr. Arpan Bhowmik*, Eldho Varghese, Seema Jaggi, Cini Varghese, and S Lall, *Computational Tools for Generation of Cost-effective Run Orders Useful for Agricultural and Industrial Research.*
- **IXth Asian Buffalo congress, ABC-2018 held at CIRB, Hisar from February 01 to February 04, 2018**
  - Neeraj Budhlakoti, *SNPRBb: Trait specific SNP Database of Bubalus bubalis.*
- **International symposium on "Emerging Areas in Biosciences and Biomedical Technologies (eBBT) 2018", organized at IIT Indore, Madhya Pradesh, during 05-06 January, 2018**
  - P.K. Meher, *Computational identification and categorization of nitrogen fixation proteins of diaztrophs using support vector machine.*

- **National seminar on "Recent trends in microbiology and biotechnology (RTMB-2018)" organized by Department of biotechnology, at MITS School of biotechnology, Bhubaneswar, ODISHA, during 16-17 March, 2018**
  - P.K Mehar, *Computational prediction of eukaryotic gene structures: probabilistic and machine learning methods.*
- **International conference on "Changing Paradigms and Emerging Challenges in Statistical Sciences (PECS-2018)" (20th Annual Conference of Society of Statistics, Computer and Applications) held at Department of Statistics, Pondicherry University, Puducherry, during 29-31 January, 2018**
  - Mohd. Harun*, Cini Varghese, Seema Jaggi, Eldho Varghese and Anindita Datta, *PTC for Comparing Test-lines with Single Control-line*.
  - Anindita Datta*, Seema Jaggi, Cini Varghese, Eldho Varghese and Mohd. Harun, *Generalized row-column designs: construction and web generation*.
  - Sukanta Dash*, B N Mandal, and Rajender Parsad, *Orthogonal and Nearly Orthogonal space filling Latin Hypercube Designs.*
  - Shashi Dahiya, *Status of eLearning in Agriculture*.
  - Soumen Pal*, Sudeep Marwaha, Alka Arora, A. K. Choubey, P. Adhiguru and Randhir Singh, *Knowledge Dissemination and Farmers' Query Resolution through KVK Portal and KVK Mobile App.*
- **5th International Conference on Computing for Sustainable Global Development 12th INDIACom-2018 held at Bharti Vidyapeeth, New Delhi during March 14-16' 2018.**

- Saravanakumar R, Alka Arora*, Rajni Jain and Sudeep Marwaha, *Automated approach to apportion time series data for dynamic district boundaries.*
- Chandan Kumar Deb, Sudeep Marwaha*, Rajni Jain, Alka Arora and Madhurima Das, *Connective based taxonomy extraction from specialized text for Ontology Learning in Agriculture.*
- Shashi Dahiya* and Anshu Bharadwaj, *Educational Data Mining in Agriculture.*

Participation in Conference/ Workshop/ Seminar/ Symposia/Training/Foundation Course/ Annual Day/ Lectures etc.

1. Participated in International Conference on Changing Paradigms and Emerging Challenges in Statistical Sciences(IPECS-2018) in conjunction with Bi-Decennial Convention of Society of Statistics, Computer and Applications during January 29-31, 2018 at Pondicherry University, Puduchery. (Dr. Anshu Bharadwaj)
2. Participated in a one day workshop on "Pradhan Mantri Fasal Bima Yojna" held at Jaipur, Rajasthan on 28 January, 2018 organized jointly by Credit and Cooperation Division, Department of Agriculture, Cooperation & Farmers Welfare (DACFW), Ministry of Agriculture & Farmers Welfare (MoAFW), Govt. of India and ICICI Lombard GIC Limited. The workshop was inaugurated by Smt. Upma Srivastava, Additional Secretary, DACFW, MoAFW, Govt. of India.(Dr. Tauqueer Ahmad)
3. Attended International Symposium on Biodiversity and Biobanking (BIODIVERSE 2018) at Guwahati, from 27-29 January 2018 jointly organized by Indian Institute of Technology Guwahati (IITG) in association with Association for Promotion of DNA Fingerprinting and Other DNA Technologies (ADNAT) and delivered invited lecture on Agricultural biodivesity and legal frame work in India: Issue, opportunity and challenges.(Dr. dinesh Kumar)
4. Attended International conference IX Asian Buffalo congress, ABC-2018 held at CIRB, Hisar from February 01 to February 04, 2018.**(**Neeraj Budhalkoti)
5. Dr. Sudeep Marwaha, Dr. Alka Arora, Dr. Anshu Bharadwaj and Dr. Shashi Dahiya attended the 5th International Conference on "Computing for Sustainable Global Development (INDIACom - 2018)"; technically sponsored by IEEE Delhi Section, held during 14th – 16th March, 2018 at Bharati Vidyapeeths Institute of Computer Applications and Management, New Delhi (INDIA).
6. Dr. RamasubramanianV. is one of the co-authors in the following three abstracts submitted for presentation in the 3rd International Symposium on Aquaculture and Fisheries Education (ISAFE3) conference to be held at ICAR-CIFE, Mumbai during 16-18 May 2018:
7. Valuing human capital generated by Universities: A case study of ICAR-CIFE by Jyotimanjari Sahoo, Ananthan, PS, Ramasubramanian, V. and Neha Qureshi
8. Forecasting human capital requirement for Indian fisheries sector: Scenario analysis of demand for and supply of professional fisheries graduates by Ananthan P. S., Ramasubramanian, V. , Jyotimanjari Sahoo and Mary Josephine
9. Are fisheries graduates of India employable? Results from a cross-country study on career choices and employability by Ananthan P. S., Ramasubramanian, V. M. Krishnan , Mary Josephine, Ubair Nisar and Hino Fernando.

10. Dr. K. N. Singh attended Hindi Workshop entitled “Statistics and Informatics for Farmer's Welfare” on 20.01.2018 at ICAR-IASRI, New Delhi.
11. Dr. Ramasubramanian V. attended Hindi Workshop entitled “Statistics and Informatics for Farmer's Welfare” on 20.01.2018 at ICAR-IASRI, New Delhi.
12. Dr. Ramasubramanian V. attended Policy cum Concluding Workshop on “Technology Enhanced Learning in Agricultural Education- The Roadmap” during 24-25 January, 2018 at ICAR-NAARM, Hyderabad.
13. Dr. Wasi Alam attended one day Hindi workshop on “—f"k esa lax.kd vuqiz;ksx” held on 19-01-2018 at IASRI, New Delhi.
14. All Scientist of IASRI attended Hindi workshop on "Statistics and Informatics for Farmer's Welfare" organized at ICAR-IASRI on January 20, 2018.
15. Susheel Kumar Sarkar attended a National Seminar on Challenges of Agricultural Policy Reforms organized by Centre for Agricultural Policy Dialogue and Techno-Economic Research Institute, New Delhi, at India International Center, New Delhi on January 05, 2018.
16. Dr. R.K. Paul attended the Review workshop of NICRA during 12-13 February 2018 at NASC complex.
17. Arpan Bhowmik participation in III LACSC: LATIN AMERICAN CONFERENCE ON STATISTICAL COMPUTING held from 27-02-2018 to 02-03-2018 at University of Costa Rica, SAN JOSÉ,COSTA RICA.
18. Seema Jaggi and Cini Varghese attended the “National Conference for Women in Statistics and Analytics” organized by Department of Statistics, Savitribai Phule Pune University, Pune during February 14-16, 2018.
19. Dr. Ramasubramanian V. attended a one day theme event entitled “Future of life on Earth – Role of disruptive technologies” conducted by TIFAC, New Delhi at IIT, Delhi as part of TIFAC’s 31st Foundation day on 10.02.2018.
20. Dr. Mukesh Kumar and Dr. Soumen Pal Participated in the Annual Review Workshop of Farmer FIRST Programme held on 21st and 22nd February, 2018 at ICAR-IASRI.
21. Dr. Mukesh Kumar, Dr. Anshu Bharadwaj participated in Fifty Sixth Convocation of the Post Graduate School, IARI during 05-09 March, 2018
22. Dr. Hukum ChanDr.a participated in the National Seminar on "Recent Advance in Statistics for Industries and Corporates" at Department of Statistics, Anand, Gujarat during 10-11 February, 2018.
23. Dr. Hukum ChanDr.a participated in the Hindi workshop on "Rajbhasa Kriyavyan avam Podha Kism Adhiniyam 2001 avam Krishak Adhikar" at ICAR-IASRI, New Delhi on 13 February, 2018.
24. Dr. Hukum ChanDr.a participated in the National workshop on "Statistical Techniques and Data Analysis using R" at Central University of Haryana, Mahendergarh, Haryana on 21 March, 2018.
25. Cini Varghese attended three days workshop cum training programme under the National Agricultural Science Fund Project “Creating a fully characterized genetic resource pipeline for mustard improvement” during 07-09 March, 2018 at CABin Centre, ICAR-IASRI.
26. Dr. U.B. Angadi Participated in “Krishi Unnathi Mela 2018 at IARI, Pusa New Delhi for presentation of mobile app “FeedGuide”.

27. Dr. U.B. Angadi Participated in"Krushi Odisha 2018" on 6th to 9th March 2018 at Bhubaneswar, Odisha for demonstration of mobile app "FeedGuide".
28. Dr. Harish Kumar HV completed three month professional attachment training from 4th December, 2017 to 3rd March, 2018 at Department of Agricultural Economics, University of Agricultural Sciences, GKVK, Bengaluru, under the mentorship of Dr. B. V. Chinnappa Reddy.

Participation in Meetings

1. Attended as expert in interview board for selection of scientist in Desert Medicine Research Centre (ICMR), Jodhpur on January 04, 2018 at Jodhpur. (Anil Rai)
2. Attended Third National Consultative Meeting on Spices Statistics at Thiruvananthapuram, Kerala on 18 January, 2018 organized by Directorate of Arecanut & Spices Development, Kozhikode, Kerala. (Tauqueer Ahmad)
3. Attended meeting on possible application of Artificial Intelligence technique in Agricultural Sector at NITI Aayog on 13 February, 2018. (Ranjit Kumar Paul)
4. Attended Technical Advisory Committee meeting of Crop Insurance on 05 February, 2018 at Krishi Bhawan, New Delhi. (Lalmohan Bhar and Tauqueer Ahmad)
5. Attended meeting on Support for Statistical Strengthening Project (SSSP) to explore the possibility of small area estimation on crop statistics and employment/ unemployment to generate disaggregate level estimate at Directorate of Economics and Statistics, Bhubaneshwar, Odisha during 22-23 February, 2018. (Hukum Chandra)
6. Attended as member in the interview committee for recruitment of a specially skilled professional and YP II under the project Assessment of climate change impacts, vulnerability and application for third national communication to UNFCCC: Agriculture, funded by Ministry of Environment & Forests, Government of India at IARI, New Delhi on 02 February, 2018. (Sanjeev Kumar)
7. Attended meeting at IASRI to finalize the Technical Assistant (T-3) result on 6.3.2018. . (Sudeep Marwaha)
8. Attended meeting held under the Chairmanship of Secretary, ICAR regarding security auditing of VOICE software on 12 March, 2018 at Krishi Bhawan (Sudeep Marwaha)
9. Attended meeting in KAB-II for Opening & Evaluation of Technical Bids – Online entrance exam for UG/PG admission on 20 March, 2018. (Sudeep Marwaha)
10. Attended meeting of Training Programme Approval Committee for the year 2018-19, NSSTA, MoSPI, Govt of India, New Delhi on 07 March, 2018. (Hukum Chandra)
11. Attended Annual Work Plan 2018-19 of the Population Research Centers (PRCs) at Ministry of Health and Family Welfare, Govt of India, New Delhi during 27-28 March, 2018. (Hukum Chandra)

12. Attended Technical Advisory Committee for the Coverage Evaluation Survey at Ministry of Health and Family Welfare, Govt of India, Govt of India, New Delhi on 28 March, 2018. (Hukum Chandra)

CONSULTANCY/ADVISORY SERVICES PROVIDED

Consultancy/ Advisory services provided:

1. Dr. Achal Lama analyzed Sugarcane price and production data for Dr. Rajesh Kumar, Principal Scientist, ICAR-IISR, Lucknow in SAS using GARCH family models.
2. Dr. Santosha Rathod Carried of data analysis on “Forecasting of Maximum Temperature of Cuttack region using ARIMA model” of Dr. P. S. hanjagi, Scientist, ICAR-National Rice Research Institute, Cuttack on 16.01.2018 in R software.
3. Prakash Kumar provided consultancy works and α-lattice design analysis,principal component analysis and Dr.aw a bi-plot for study of 44 wheat genotype datafrom various environmental condition provided by Gurumurthy S., Ph.D. student IARI, New Delhi.
4. Dr. U.B. Angadi consultancy service project with International Livestock Research Institute (ILRI) is in progress and total consultancy fee is Rs.3,96,750/- for 23 man-days.
5. Dr. M. A. Iquebal advised to Dr. Amlendu Ghosh, Scientist, IARI, New Delhi regarding designing of transcriptome experiment for further data generation.
6. Dr. Pradip Basak provided advisory services to Mr. Utpal Ekka, Scientist, ICAR-Indian Agricultural Research Institute, Pusa, New Delhi.
7. Dr.P.K. Meher provided Genotype×Environment interaction analysis was carried out for 230 genotypes in two different environments with 2 replications in each location. The analysis was performed for 8 different nutritional traits of wheat crop. The analysis was conducted using AMMI model with the packages of R-software.
8. Dr. Pradip Basak analyzed the ergonomic data of Mrs. Kumari Chanchala Priya, PhD student, Indian Agricultural Research Institute, New Delhi.
9. Dr. U.B. Angadi Consultancy service project with International Livestock Research Institute (ILRI) is in progress and total consultancy fee is Rs.3,96,750/- for 23 man-days
10. New consultancy service proposal “Development database and analysis tool for feed demand-supply assessment in Mali, West Africa” has been prepared with ILRI South_Asia Region, New Delhi and submitted the same for approval. Total consultancy fee is Rs.4,42, 500/- for 25 man-days. Some queries from ADG are clarified and submitted to Office.
11. Dr. M. A. Iquebal Advised services provided to Dr. Soham Roy, Scientist, ICAR-CRIJAF, Barrack pore regarding insilico finding of polymorphic SSR markers.
12. Dr. U.B. Angadi Consultancy service project with International Livestock Research Institute (ILRI) is in progress and total consultancy fee is Rs.3,96,750/- for 23 man-days
13. Dr. U.B. Angadi New consultancy service proposal “Development database and analysis tool for feed demand-supply assessment in Mali, West Africa” has been prepared with ILRI

South_Asia Region, New Delhi and submitted the same for approval. Total consultancy fee is Rs.4,42, 500/- for 25 man-days.

14. Dr. M. A. Iquebal and Dr. Sarika advised services provided to Mr. Ashutosh Kumar, Ph.D. student, PAU, Ludhiana insilico mining of SNP markers.
15. Dr. Santosha Rathod advised Ph.D. Student, Murali from ICAR-IARI on the procedure of analysis using SAS of an experiment conducted in Factorial RBD three replications on 27.03.2018.

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PERSONNEL

Retirement(s)

- Dr. Anjani Kumar Chaubey, Head and Officiating Director retired and demitted the office on 21.01.2018.

ICAR-IASRI NEWS

Volume 22 No. 4 January-March, 2018

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Published by

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