



ICAR-IASRI



Volume 24

No. 3

NEWS

October-December, 2019

- Research Activities
- Awards and Recognition
- Human Resource Development
- Panorama of Activities
- Publications
- Lectures Delivered
- Participation
- Consultancy/Advisory Services
- Personnel

From the Director's desk ...

This Newsletter highlights the salient research achievements, recognitions received and details about visit abroad by our Scientists, training programmes conducted, workshops and conferences organized and significant publications of our Institute during the period under report. Apart from these, we are proud to share about the proceedings of a mammoth event namely, Eighth International Conference on Agricultural Statistics (ICAS-VIII) organized during 18-21, November 2019 at New Delhi by the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers' Welfare (MoA&FW), Government of India, the task of organizing of which was entrusted to our institute by DARE and was indeed successfully organized.



The aforementioned ICAS-VIII Conference was organized mainly by our institute under the able leadership of Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR. The theme of ICAS-VIII was 'Statistics for Transformation of Agriculture to Achieve the Sustainable Development Goals (SDGs)'. The Conference was inaugurated by Shri Bill Gates, Co-Chair, Bill & Melinda Gates Foundation in the presence of Shri Narendra Singh Tomar, Union Minister of Agriculture and Farmers' Welfare, Rural Development and Panchayati Raj who presided over the inaugural function of the Conference and Guest of Honour was Shri Kailash Choudhary, Union Minister of State for Agriculture and Farmers' Welfare. This Conference was attended by more than 500 delegates from around 100 countries across the globe. ICAS-VIII was also annexed with three side events as post-conference events.

Sampling methodology for generating state level estimates of crop area and yield for major foodgrain crops using the sample sizes recommended by Prof Vaidyanathan Committee report has been developed wherein the estimates obtained from reduced sample sizes in terms of number of Crop Cutting Experiments produced reliable estimates with acceptable level of precision for major crops. In addition, a universal tool for polymorphic microsatellite marker discovery from whole genome and transcriptome data, namely, PolyMorphPredict was developed. Moreover, development of Generalized Row-Column (GRC) designs balanced for spatial indirect effects has been done for prime number of treatments.

Our Scientists have brought laurels to the institute by way of receiving young scientist awards from prestigious scientific societies. Our Scientists have also served as organizing secretaries,

experts and distinguished members for various committees and conferences and thus have brought recognitions to our institute. Two of our Scientists have visited abroad gaining international exposure.

Eight training programmes were conducted on a wide range of topics viz., Advances in designing and analysis of field crop experiments, Sampling design and schedules for implementation of energy audit survey, Field survey, data collection, compilation and analysis, Recent advances in sample survey and data analysis using statistical software, High dimensional genome data analysis by R and open source tools, Recent advances of bioinformatics in agricultural research: A practical perspective, Statistical and machine learning techniques for modeling and forecasting agricultural data and also it is heartening to note that our institute has conducted one training programme exclusively in Hindi. Many workshops have also been organized during the reporting period.

I am also glad to announce that a good number of publications have come out during this period. Many computer packages have been developed, particularly in R software which have also been submitted and uploaded in the Comprehensive R Archive Network (CRAN) for its wide use across the globe.

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.



(Tauqueer Ahmad)

Eighth International Conference on Agricultural Statistics (ICAS-VIII) held at New Delhi during November 18-21, 2019



Eighth International Conference on Agricultural Statistics (ICAS-VIII) was organized during 18-21, November 2019 at New Delhi by the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers' Welfare (MoA&FW), Government of India with active participation from Department of Agriculture Cooperation & Farmers Welfare (DAC&FW) under MoA&FW and in close collaboration with the Food and Agriculture Organization (FAO) of the United Nations, the US Department of Agriculture (USDA), International Statistics Institute-Committee on Agricultural Statistics (ISI-CAS), EUROSTAT, and many other international organizations besides national organizations like Ministry of Statistics and Programme Implementation (MoSPI). It is emphasized here that, the DARE, under its valuable guidance, entrusted the task of organizing this mammoth event to our institute ICAR-Indian Agricultural Statistics Research Institute (IASRI), New Delhi which jointly worked with Indian Society of Agricultural Statistics (ISAS), New Delhi and National Academy of Agricultural Sciences (NAAS), New Delhi for smooth conduct of the event. The theme of ICAS-VIII was Statistics for Transformation of Agriculture to Achieve the Sustainable Development Goals (SDGs).

International Conference on Agricultural Statistics (ICAS) is a series of conferences, promoted by FAO, World Bank (WB), USDA, ISI-CAS and other international development agencies, which started in 1998 based on the overarching need for agricultural data worldwide. Earlier seven such conferences have been hosted in different countries viz. USA, Italy (twice), Mexico, China, Uganda and Brazil. We were proud to organize such an event this time as ICAS-VIII at New Delhi.

The inaugural function was held on November 18, 2019 at National Agricultural Science Complex, New Delhi and other thematic sessions were held during 19-21 November 2019 at The Ashok Hotel, New Delhi. The inaugural function was attended by approximately 1100 participants consisting of conference delegates, officials from various Ministries, volunteers and students. The Conference was inaugurated by Shri Bill Gates, Co-Chair, Bill & Melinda Gates Foundation in the presence of Shri Narendra Singh Tomar, Union Minister of Agriculture and Farmers' Welfare, Rural Development and Panchayati Raj who presided over the inaugural function of the conference and Guest of Honour Shri Kailash Choudhary, Union Minister of State for Agriculture and Farmers' Welfare. Shri Tomar stated that it was a proud moment for India to host the ICAS event. He stressed on the importance of agricultural statistics in realizing the Government of India's various agricultural-centric schemes. The

Minister stated that the subject of statistics holds a crucial place in agriculture like other spheres of life. Shri Tomar regarded the conference to be a great opportunity for the national and international experts to share and exchange their expertise in the field of statistics. While applauding the various statisticians and scientists working in the field of the agricultural statistics, Shri Kailash Choudhary, Union Minister of State for Agriculture and Farmers' Welfare highlighted about the Government's various schemes that are aimed at doubling the farmers' income. He emphasized that the four-day conference will be a fruitful opportunity in realizing the desired goals.

Shri Bill Gates, Co-Chair, Bill & Melinda Gates Foundation, addressed the audience on the theme of improving agricultural productivity using data and innovative technologies. In his speech on the occasion, he said, "In the hands of a single smallholder, the right information can lead to a 20% revenue increase for one farm." He further added, "We can help the world's two billion smallholders adapt to climate change much quicker if everybody in the agriculture sector has access to quality information".

While delivering welcome address during the inauguration of the ICAS event, Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR accentuated that prompt management of agricultural statistics is vital for agriculture-centric country like India. Dr. Mohapatra stressed that in order to deal with the challenges posed due to climate change, enhancing the farmers' income, eradicating poverty and malnutrition and meeting the vision of sustainable development goals, joint efforts are required for strengthening the statistical system which in turn will pave way for achieving these targets. He pointed out that ICAR through one of its Institutes i.e. IASRI, has given valuable contributions in the field of agricultural statistics including, but not limited to, crop cutting experiments which are being implemented globally and thus aptly the conference has been held in India. He stressed that the roots of statistics can be traced to Indian epics and historical texts and thus we have now not only a full-fledged national statistical system but also national agricultural statistics system. He opined that integration and triangulation of data coupled with modern techniques of remote sensing and GIS has become the order of the day. He quoted the words of the legendary and world renowned agriculturist Prof. M.S. Swaminathan that "It is the effective use of tools of statistical design of experiments that paved the way for green revolution". He suggested the need ourselves to rededicate towards strengthening the statistical system so that the statistical quality of data in real time is ensured and start working towards designing cloud computing, use of Artificial Intelligence and Big Data analytics which has become highly necessary in this digital era. Highlighting the importance of SDGs, he mentioned that it will help in eradicating the problems and challenges of malnutrition in an effective manner and that ICAR is committed towards achieving these goals. Dr. Mohapatra expected that the conference will help in discussing and framing the new policies and future action plans. He emphasized that the seminar is intended for young statisticians working in the field of agricultural statistics, or statisticians new to the field of agricultural statistics.

This conference has been attended by 500+ delegates from 100+ countries across the globe. Intellectual expertise and experiences were shared through 288 papers comprising of 18 plenary talks and panel discussions, 165 thematic oral presentations, 95 poster presentations and rich academic discussions during the presentations.

Shri Pietro Gennari, Chief Statistician, FAO, Rome, Italy; Ms. Mariana Kotzeva, Director General, EUROSTAT and Prof. Ramesh Chand, Member, NITI Aayog, India where some of the Keynote Speakers during the Conference. Prof. Ramesh Chand, Member, NITI Aayog, India stressed on

adoption of effective ways to monitor the statistics of agricultural data with promptness and efficiency. He also emphasized on electronically monitoring of the statistical data. This would help in saving the time and maintain the accuracy of the data. Shri Pietro Gennari, Chief Statistician, FAO, Rome mentioned that the conference has provided a great platform for the experts of the agricultural field to interact and exchange their expertise of agricultural statistics. He stressed that it was indeed a great opportunity to discuss and finalize the several future plans on maintaining and monitoring the agricultural statistics data promptly. Shri Pravin Srivastava, Secretary, Ministry of Statistics and Programme Implementation stated that the huge informal economy in India poses challenges to collect statistical data. As the manual data collection is a challenge, it is necessary to adopt the latest technologies for the agricultural statistical data collection. Dr. Michael Steiner, ISI CAS and World Bank, who was also the Chair for the Scientific Programme Committee of ICAS, stated that it is pertinent to organize such types of conferences in the agriculture-centric countries like India. He emphasized on the importance of managing the agricultural statistics for the overall development of the country. Shri Ugo Astuto, Ambassador-Designate, European Union of India stated that the statistical data helps to realize the SDGs. It plays a crucial role to monitor the progress of the country. The presentations in the plenary sessions along with the thematic sessions have laid the foundation stone for building the beautiful monument of achieving SDGs with mutual partnerships, collaboration and understanding.

Earlier, while speaking during a curtain raiser organized prior to ICAS event, Dr. Purvi Mehta, Senior Advisor and Head of Agriculture for Asia, Bill & Melinda Gates Foundation (BMGF) highlighted about the huge potential in agricultural statistics in India. She stated that the conference will be a great opportunity for the various scientists and experts of agricultural fields to exchange their expertise with each other. This would help to enhance the agricultural scenario both at the country and the international level too. Dr. Mehta also highlighted that the conference will help in evidence-based policy making. She accentuated that the conference will help in Government of India's vision of doubling the farmers' income effectively and efficiently.

In his Valedictory address, Dr. Trilochan Mohapatra emphasized on enhancing capacity building in data interpretation and data analysis than in data collection through the global partnership. The Director General urged the countries for identifying their special strengths and sharing them with others wherever the deficiencies are present. He opined to create a Global Knowledge Hub for Agricultural Statistics (GKHAS). He emphasized on working towards global public good. He urged for supporting the evidence-based decision making through data analytics by creating investments in infrastructure and capacity building. He opined for filling-up the data gaps by investments in infrastructure, diversification in agriculture and providing easy market access to the farmers. He regarded data as the driver of change. He opined for developing the business models involving government and private sectors. He mentioned that it is important for identifying how data can serve as an important resource not just for farm-related decision support, but also all the more important for framing farmer-centric policy in the developing countries. Dr. Michael Steiner, Chairman, ISI CAS and Chair, Scientific Programme Committee, ICAS VIII opined that technology speeds up opportunities, but it poses challenges too. He stressed that the use of technology helps in generating timely and accurate data, but it should not be considered as a complete replacement of surveys. Modern technologies for data generation need to be taken up and strengthened along with surveys. With the availability of high resolution data, precision of data collection has improved, but without strong and accurate ground truth data, remote sensing alone may not be an answer.

The 2030 Agenda encompasses a far broader ambition requiring better, more timely and reliable data on a wider variety of indicators for evaluating and monitoring of SDGs. Thus, its adoption by countries around the world necessitates an even more significant increase in the data that is available to, and used by, governments, civil society, the private sector, academia and international organizations to begin tracking progress towards the achievement of the SDGs.

ICAS-VIII was also annexed with three side events as post-conference events on the use of methods and standards for the collection and analysis of agricultural statistics namely
 (i) Methodology for Agricultural Censuses and Surveys for Young Statisticians by USDA
 (ii) Using Administrative Data for Agricultural Statistics by EUROSTAT and
 (iii) Closing the Agricultural Data Gap through Agricultural Integrated Surveys by FAO

Significant Research Achievements Oct-Dec-2019:

<p>Statistical methodologies/ tools/ techniques developed</p>	<p>Development of sampling methodology for generating State level estimates of crop area and yield from the sample sizes recommended by Prof Vaidyanathan Committee report: From the study, it was found that, the methodology for obtaining yield estimates from reduced sample sizes (reduced number of Crop Cutting Experiments i.e. CCEs with respect to General Crop Estimation Surveys i.e. GCES), produced reliable estimates with acceptable level of precision for major food grain crops at State level.</p> <p><i>PolyMorphPredict</i> - A universal tool for polymorphic microsatellite marker discovery from whole genome and transcriptome data: This polymorphism detection tool, PolyMorphPredict has three modules which work together irrespective of the languages used like Perl (64 bit, version 5), R (version 3.0) or Java (version 7). Such type of tool is required for agriculture research as DNA marker based breeding does not have transgenic issues. It will help in better identification of genes, QTL controlling trait, increase in marker density and localisation of scaffolds over linkage map. It will give better precision than QTL mapping, physical absolute distance rather than relative distance mapping. SSR polymorphism tool can be applied in crop sciences for diversity and core set analysis, QTL mapping, association mapping, MAS, DUS testing. It also has wide application in animal sciences for diversity analysis, breed identification, mapping, kinship and parentage identification as well as traceability of product. This tool is freely available and can be accessed at http://webtom.cabgrid.res.in/polypred/.</p> <p>Development of Generalized Row-Column (GRC) designs balanced for spatial indirect effects: A series of GRC designs balanced for spatial indirect effects have been developed for prime number of treatments.</p>
<p>R-Packages developed</p>	<p>“varEst” for Variance Estimation https://CRAN.R-project.org/package=varEst. “STGS” for Genomic Selection using Single Trait https://CRAN.R-project.org/package=STGS. “MTGS” for Genomic Selection using Multiple Trait https://CRAN.R-project.org/package=MTGS “GSelection” for Genomic Selection https://CRAN.R-project.org/package=GSelection. “BayesBEKK” for Bayesian Estimation of Bivariate Volatility Model https://cran.r-project.org/web/packages/BayesBEKK/index.html</p>

Honours/ Awards:

- Kanchan Sinha, Scientist received Young Scientist Award from the Society for Scientific Development in Agriculture and Technology for his contribution in the field of forecasting and agricultural systems modelling in International Conference on Global Research Initiatives for Sustainable Agriculture and Allied Sciences (GRISAAS-2019) held during 20-22 October, 2019 at ICAR-NAARM, Hyderabad, Telangana.
- Achal Lama, Scientist received CWSS Young Scientist Award 2020 in International Seminar on Agriskills for Convergence in Research, Industry and Livelihood (ACRIL) held during 28 November to 01 December 2019 at BCKV, Kalyani, West Bengal.
- Nobin C Paul, Prachi M Sahoo, Tauqueer Ahmad, R.N. Sahoo, Gopal Krishna and S.B. Lal received Best Paper Award for research paper entitled "Acreage estimation of mango orchards using hyperspectral satellite data" published in Indian Journal of Horticulture, Vol. 75 (1), March 2018 / PP 27-33 on 29th November, 2019.

Recognitions:

- Lal Mohan Bhar, Head (A), Genetical Statistics was Organizing Secretary, Eighth International Conference on Agricultural Statistics held at New Delhi during November 18-21, 2019.
- Rajender Parsad, Principal Scientist was Co-Organizing Secretary, Eighth International Conference on Agricultural Statistics held at New Delhi during November 18-21, 2019.
- Anil Rai, Head (A), CABIn
 - was Chairman of the Committee for conducting examination of the recruitment of administrative personnel in ICAR.
 - was Member of Examination Committee for admission of UG/PG/Ph.D. students in different agricultural universities.
 - was Member of DPC at ICAR-Research Complex for Eastern Region, Patna for the promotion of Scientists.
- Hukum Chandra, ICAR National Fellow
 - was Member Secretary, Quinquennial Review Team (QRT) of ICAR-IASRI, New Delhi for the Period 2011-2018.
 - was Expert, Internal Evaluation Committee for validation of Sampling Plan at ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI), Bengaluru during 2019.
 - was Associate Editor, Journal of Statistical Theory and Practice.
 - was Expert, Assessment of the Candidate for Promotion to the Position of an Associate Professor, Indian Statistical Institute, Kolkata during 2019.
 - was Member Secretary, Young Statisticians Conference, New Delhi, India held during 22-23 November, 2019 which was hosted by DARE, Ministry of Agriculture and Farmers Welfare, Government of India and sponsored by United State Department of Agriculture, USA.
 - was Expert Member, Food and Agricultural Organization (FAO) in the activities related to Monitoring and Analyzing Food and Agricultural Policies Programme in collaboration with NITI Aayog and Corporate Outcome Assessment Survey, FAO, India.
 - was the Expert Member, Myanmar Agricultural Census 2020, Food and Agricultural Organization (FAO) of the United Nations, Myanmar during 15-21 December, 2019.
- Tauqueer Ahmad, Director, ICAR-IASRI

- was Honorary Secretary, Indian Society of Agricultural Statistics.
- was Coordinating Editor, Indian Society of Agricultural Statistics.
- Organized Eighth International Conference on Agricultural Statistics (ICAS VIII) during 18-21 November 2019 as Director of the Institute.
- was Chairman, Institute Management Committee (IMC)
- was Chairman, Institute Deputation Committee (IDC)
- was Chairman, Project Monitoring Committee (PMC)
- was Chairman, Institute Joint Staff Council (IJSC)

Visits Abroad:

- Sudeep Marwaha, Head (A), Division of Computer Applications and Mukesh Kumar, Principal Scientist visited four countries viz., Netherlands, Germany, Belgium & Switzerland for attending ten days Effective Development Programme (EDP) cum exposure visit on “Development Effective Organizational Leadership for Senior Officers of ICAR” during October 12-21, 2019.

Human Resource Development:

Training programs organized:

SN	Title	Period
1.	Advances in designing and analysis of field crop experiments <i>Course Director</i> Anil Kumar <i>Co-Course Directors</i> Susheel Kumar Sarkar Sukanta Dash	14.10.2019 to 03.11.2019
2.	Sampling design and schedules for implementation of energy audit survey <i>Course Director</i> Hukum Chandra	01.11.2019 to 02.11.2019
3.	Field survey, data collection, compilation and analysis <i>Course Director</i> Tauqueer Ahmad <i>Course Coordinators</i> Prachi Misra Sahoo Raju Kumar	04.11.2019 to 08.11.2019
4.	Recent advances in sample survey and data analysis using statistical software <i>Course Coordinator</i> Hukum Chandra <i>Co-Course Coordinators</i> Kaustav Aditya Pradip Basak	28.11.2019 to 18.12.2019
5.	High dimensional genome data analysis by R and open source tools <i>Course Coordinators</i> P.K. Meher A.R. Rao	01.11.2019 to 11.11.2019

6.	Recent advances of bioinformatics in agricultural research: A practical perspective <i>Course Coordinator</i> Md. Samir Farooqi <i>Co-Course Coordinators</i> K.K.Chaturvedi D.C.Mishra	12.12.2019 to 21.12.2019
7	Statistical and machine learning techniques for modeling and forecasting agricultural data <i>Course Coordinator</i> Mrinmoy Ray <i>Co-Course Coordinators</i> Shivaswamy, G. P. HarishKumar H. V.	20.12.2019 to 09.01.2020
8	जैवसूचनाविज्ञान: टूल्स एवं तकनीकियां <i>Course Coordinator</i> D.C. Mishra <i>Co-Course Coordinator</i> Anu Sharma	09.12.2019 to 11.12.2019

New Projects Initiated:

Leveraging Institutional Innovations for Inclusive and Market led Agricultural Growth in Eastern India; Funded by NASF; Project Period: 01.12.2019 to 30.11.2022

Conferences/Workshops/Seminars/Symposia/Meetings organized:

- Two workshops(one day duration each) on Financial Management System for Administrative and Finance Officers of ICAR institutes on 15 October, 2019 and on 21 October, 2019.
- One day workshop on Financial Management System organized for Administrative and Finance Officers of ICAR institutes on 31 October, 2019.
- Meeting of Quinquennial Review Team (QRT) of ICAR-IASRI for the period of 2011-12 to 2017-18 during 18-19 October, 2019.
- Eighth International Conference on Agricultural Statistics (ICAS-VIII) at NASC Complex and The Ashok Hotel, New Delhi during 18-21 November, 2019.
- NAHEP sponsored Training programme on High Dimensional Genome Data Analysis by R and Open Source Tools during 01-11 November, 2019.
- Sensitization workshop on NAHEP component -2A Activities & Implementation of Academic Management System(AMS) at C.S. Azad University of Agriculture & Technology, Kanpur, U.P. during 28-29 November, 2019.

- Young Statisticians Seminar on Methodology for Agricultural Censuses and Surveys sponsored by USDA held at NASC Complex, New Delhi during 22-23 November, 2019.
- IV National Workshop of Officer-In-Charge, Data Management during 10-11, December, 2019.
- Meeting of ICAR Institutes on Precision Agriculture in NASC Complex on 09 December, 2019.
- Meeting of ICAR Institutes on Precision Agriculture in NASC Complex under the Chairmanship of Secretary, DARE and DG, ICAR was organized on 26 December, 2019 by Dr. Anil Rai, ADG(ICT).
- Fourth National Workshop of Officer-In-Charge, Data Management (ICAR Research Data Repository for Knowledge Management) at NASC Complex during 10-11 December, 2019.
- Training programme on “E-Governance Applications in ICAR” under the aegis of HRM at ICAR-IASRI during 16-20 December 2019.

Publications

Research Papers Published in Referred Research Journals:

1. Aditya, K. Chandra, H Kumar, S, Nayak N and Das, S (2019). Mobile Assisted Personal Interview Software-Development and Experiences from Implementation in Crop Estimation Survey in India. *Journal of the Indian Society of Agricultural Statistics*, **73(3)**: 257-263.
2. Bhowmik, A, Jaggi, S, Varghese, E & Varghese, C (2019). A note on optimal directional neighbour designs with random block effect. *Communications in Statistics - Simulation and Computation*, DOI:10.1080/03610918.2019.1568475.
3. Choudhary, VK, Kumar, S, Meena, LR, Kumar, A, Panwar, S, Mishra, DR and Thakur, BK (2019). Design and Implementation of Web-based Information System for Region-Specific Synthesized Integrated Farming Models in India. *International Journal of Applied Research on Information Technology and Computing*, **10(1)**: 9-19.
4. Dasgupta, P., Ahmad, T., Rai, A. and Biswas, A. (2019). Bootstrap Variance Estimation Technique under Dual Frame Ranked Set Sampling. *Journal of the Indian Society of Agricultural Statistics*, **73(3)**, 197–206.
5. Grover, M, Mishra, DC, Kumar, RR and Kaur, M (2019). A decade of research in quantum bioinformatics: a quantum computational view of the universe with special reference to living organisms. *International Journal of Current Research*, **11(10)**: 7769-7770.
6. Krishna, G., Sahoo, R.N., Singh, P., Bajpai, V., Patra, H., Kumar, S., Dandapani, R., Gupta, V.K., Viswanathan, C., Ahmad, T. and Sahoo, P.M. (2019). Comparison of various modelling approaches for water deficit stress monitoring in rice crop through hyperspectral remote sensing, *Agricultural Water Management*, **213**, 231-244. Available at <https://doi.org/10.1016/j.agwat.2018.08.029>
7. Kumar, D, Chhokar, V, Sheoran, S, Singh, R, Sharma, P, Jaiswal, S, Iquebal, MA, Jaiswar, A, Jaisri, J, Angadi, UB, Rai, A, Singh, GP, Kumar, D, Tiwari, R (2019). Characterization of genetic diversity and population structure in wheat using array based SNP markers, *Molecular Biology Reports*, <https://doi.org/10.1007/s11033-019-05132-8>.

8. Kumari, V, Aditya, K, Chandra, H and Kumar, A (2019). Bayesian Discriminant Function Analysis Based Forecasting of Crop Yield in Kanpur District of Uttar Pradesh. *Journal of Agrometeorology*, **21(4)**: 462-467.
9. Majumdar, SG, Rai, A and Mishra, DC (2019). Integrated Framework for Selection of Additive and Nonadditive Genetic Markers for Genomic Selection. *Journal of Computational Biology*, <https://doi.org/10.1089/cmb.2019.0223>.
10. Misra, T, Arora, A, Marwaha, S, Ray, M, Raju, D, Kumar, S, Sahoo, RN and Chinnusamy, V (2019). Artificial neural network approach for estimating leaf freshweight (LFW) of rice plant through VISUAL-NIR (VIS-NIR) imaging. *Indian Journal of Agricultural Sciences*, **89 (10)**: 1698-1702.
11. Mukherjee, A, Singh, P, Rakshit, S, Priya, S, Burman, RR, Shubha, K, Sinha, K and Nikam, V (2019). Effectiveness of poultry based Farmers' Producer Organization and its impact on livelihood enhancement of rural women. *Indian Journal of Animal Sciences*, **89(10)**: 1152-1160.
12. Narsimhaiah, L, Sahu, PK, Singh, SHH, Sinha, K, Dey, S and Pandit, P (2019). Modelling and forecasting of arecanut production in India-vision 2020. *International Journal of Current Microbiology and Applied Sciences*, **8(11)**: 728-738.
13. Narsimhaiah, L, Sahu, PK, Sinha, K, Singh, SHH, Dey, S and Pandit, P (2019). Forecasting of coconut production in India: An approach with ARIMA, ARIMAX and combined forecast techniques. *International Journal of Current Microbiology and Applied Sciences*, **8(11)**: 1710-1719.
14. Nathamuni, S, Jangam, AK, Katneni, VK, Selvaraj, A, Krishnan, K, Kumar, S, Avunje, S, Balasubramaniam, S, Grover, M, Alavandi, SV, Koyadan1, VK (2019). Insights on genomic diversity of *Vibrio* spp. through Pan-genome analysis. *Annals of Microbiology*, <https://doi.org/10.1007/s13213-019-01539-7>.
15. Pandirwar, AP, Kumar, A, Singh, JK, Mani, I and Bhowmik, A (2019). Development and Evaluation of Semi-Automatic Six Row Onion Seedlings Transplanter. *Agricultural Mechanization in Asia, Africa and Latin America*, **50(1)**: 29-35.
16. Panwar, S, Kumar, N, Kumar, A, Paul, RK and Sarkar, SK (2019). Analysis of trend in area, production and productivity of okra (*Abelmoschus esculentus*) in India. *Current Horticulture*, **7(2)**: 56-58. <https://doi.org/10.5958/2455-7560.2019.00021.9>.
17. Parui, S, Parsad, R, Mandal, BN and Dash, S (2019). Block designs for incomplete factorial treatment structures with two factors. *Communications-in-Statistics: Theory and Methods*, **48(24)**: 6038-6053, <https://doi.org/10-1080/03610926.2018.1524911>.
18. Paul, RK, Vennila, S, Bhat, MN, Yadav, SK, Sharma, VK, Nisar, S and Panwar, S (2019). Prediction of early blight severity in tomato (*Solanum lycopersicum*) by machine learning technique. *Indian Journal of Agricultural Sciences*, **89 (1)**: 169-175.
19. Ray, M and Ramasubramanian, V (2019). Power computation based performance assessment of ARIMA intervention modeling. *Journal of the Indian Society of Agricultural Statistics*, **73(3)**: 233-242.
20. Singh, D, Kumar, R, Yadav, SK, Roy, HS, Biswas, A and Shekhawat, RS (2019). A study on problems of major pulses producers and their solutions in India. *Bhartiya Krishi Anushandhan Patrika*, **34(2)**: 92-98, DOI: 10.18805/BKAP162.
21. Tripathy, P, Ramasubramanian V, Krishnan, M and Ananthan, PS (2019). A study on the comparison of income between fishing activity and alternative livelihoods of Rushikulya fishers of Odisha. *Journal of Experimental Zoology*, **22(1)**: 569-72.
22. Varghese, E, Bhowmik, A, Jaggi, S, Varghese, C and Lall, S (2019). On the construction of response surface designs with minimum level changes. *Utilitas Mathematica*, **110**: 293-303.

23. Verma, RK, Wason, M, Padaria, RN, Singh, P, Sarkar, S and Bhowmik, A (2018). Effectiveness of Information and Communication Technology based Advisory Services in Addressing Information Need of Rural Women: A Case of Connecting Dream Foundation. *Indian Journal of Extension Education*, **54(2)**: 148-152.
24. Yadav, SP, Sarkar, SK, Mahapatra, RK, Kannaki, TR, Dange, M, Bhattacharya, TK, Chatterjee, RN (2019). Modeling growth curves for Indian Native vs Exotic chicken breeds to assist in selection. *Indian Journal of Animal Sciences*, **89(8)**: 898–902.

Reference-Manual /Manual/E-manual/Pamphlet:

- Advances in Data Science using R. Reference Manual of CAFT programme organized during September 21-October 11, 2019, ICAR-IASRI, New Delhi Publication.
- Statistical and Machine Learning Techniques for Modeling and Forecasting Agricultural Data. Training Manual-I, ICAR-IASRI, New Delhi Publication.
- Statistical and Machine Learning Techniques for Modeling and Forecasting Agricultural Data. Training Manual-II, ICAR-IASRI, New Delhi Publication.
- Recent Advances in Sample Survey and Data Analysis using Statistical Software. Reference e-Manual-I of Centre of Advanced Faculty Training (CAFT) organized during 28 November-18 December, 2019. ICAR-IASRI, New Delhi Publication.
- Recent Advances in Sample Survey and Data Analysis using Statistical Software. Reference e-Manual-II of Centre of Advanced Faculty Training (CAFT) organized during 28 November-18 December, 2019, ICAR-IASRI, New Delhi Publication.
- Recent Advances of Bioinformatics in Agricultural Research: A Practical Perspective”. E-Manual for HRM sponsored training program, IASRI Publication.
- Field Survey, data collection, compilation and analysis. Reference Manual of Training programme organized during 04-08 November 2019, ICAR-IASRI, New Delhi publication.
- Field Survey, data collection, compilation and analysis. E-Manual of Training programme organized during 04-08 November 2019, ICAR-IASRI, New Delhi publication.
- जैवसूचनाविज्ञान: टूल्स एवं तकनीकियां E-Manual for Hindi training programme, IASRI Publication.



एक कदम स्वच्छता की ओर



हर कदम, हर उमर

किसानों का हमसफर

भारतीय कृषि अनुसंधान परिषद

Agriseach with a human touch

Compiled and edited:

Tauqueer Ahmad

Ajit

&

Ramasubramanian V.

Technical Assistance:

Anil Kumar Kochlay

V.P.Singh

&

Naresh Kumar

Published by

Director

ICAR-Indian Agricultural Statistics Research Institute,
Library Avenue, Pusa, New Delhi - 110 012 (INDIA)

E-mail : director.iasri@icar.gov.in;

ICAR-IASRI

Library Avenue, Pusa, New Delhi - 110 012 (INDIA)

E-mail : director.iasri@icar.gov.in;

Website : <https://iasri.icar.gov.in/>

Phone: +91 11 25841479

Fax: +91 11 25841564

Typesetting and formatting: Ms. Priyasa Mall